RAILROAD GAZETTE

FRIDAY, AUGUST 4, 1893.

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Contributions

A Truly Modest State in Trouble.

Texas Central Railroad Company,
WACO, Tex., July 22, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have your circular letter of the 23d ult., and would suggest that you select inopportune times to promulgate inquiries concerning the construction of new railroads in Texas. It occurs to me that I replied to a similar communication some time ago, at a time when the railroads in Texas were being managed by the Commission; the same answer perhaps would not apply now, but as the circumstances are somewhat similar I might respond by asking if you had heard anything about a "flurry in financial circles" or a "tightness in the money market;" or has your attention been attracted to the utterances of President Cleveland, who says: "The derangement of our currency is a menace to the country's welfare and prosperity, and that no one can fail to see that fear and apprehension in monetary circles will ultimately bring suffering to every humble home in our land?"

You may think that Texas is not included in "our land," but I assure you we are very much in it. Although we are very much bigger than the rest of the land, we are not feeling big at the present time, notwithstanding the success achieved in rendering navigable the Trinity River from Galveston to Dallas.

You pay our railroad a high compliment by conceding that we are in position to let contracts for grading, for tracklaying, for the boring of tunnels, for the erection of iron bridges, and for making financial arrangements for equipping the road; for which I thank you very much, as we have a splendid property, which, by judicious extensions, can be made one of the best: one that can take care of its obligations from the beginning, and never be called upon to make the acquaintance of a receiver or to indulge in the luxury of a special master; but for obvious reasons we will defer making any extensions in the immediate future. . . .

Although Texas is as large as all New England, or New York, New Jersey, Delaware, Maryland, Pennsylvania, Ohio, and part of Indiana, yet its size is only one of its characteristics; it has more coal area than Pennsylvania, more iron than Alabama, more granite than New Hampshire, more pine than Wisconsin, more oak than West Virginia, more prairie than Kansas, more corn land than Illinois, more wheat land than the two Dakotas, more cotton land than Mississippi, more sugar land than Louisiana and more rice land than South Carolina; it contains as many rivers as any other five States, and has 500 miles of sea coast; it has 8,000 miles of railroad, and room for 8,000 miles more; and I hope that the conditions will change soon, so as to permit us to be "in it" when the construction of this additional 8,000 miles is rendered possible.

Did it ever occur to you to ascertain the effect of an act of the Texas Legislature, approved April 8, to take effect 90 days after adjournment, entitled "An act to define franchises; to make public the value of railroads; to limit the amount of stocks and bonds and other indebtedness that may be issued by railroad companies; and to regulate the manner of issuing, registering and securing the same; to prescribe penalties for violating the provisions of this act, and to prescribe the duties of the Railroad Commission and the Attorney-General in relation thereto"? For fear that you have not seen this act, I send you a copy of it, which I would ask you to read carefully and say if you see anything in it that is encouraging to the further construction of railroads in Texas. CHARLES HAMILTON, *Vice-President.*

The pamphlet sent by Colonel Hamilton contains the Texas law of April 8 last, the chief provisions of which are as follows: Section 2 provides that a railroad shall not issue bonds or other indebtedness above the reasonable value of its property, except that in emergency the State Railroad Commission may authorize bonds to the extent of 50 per cent. above the value of the property. Section 3 requires the Railroad Commission to ascertain the value of each railroad, with its franchises, giving the roads fair opportunity to protest before the valuation is recorded with the Secretary of State. The Commission may correct its valuation at any time. Section 4 is a provision intended to make sure that in any reorganization of a railroad the stock shall be thoroughly wiped out. Section 6 provides regulations for issuing bonds in advance of the completion of a railroad. The company must get the consent of the Railroad Commission, exhibiting its contract with the construction company, and giving full information generally. Sections 7, 8 and 9 provide stringent regulations for issuing stock and bonds. The entire proceedings must be had at the office of the company, in the State of Texas, and be reported to the Secretary of State. This report must be very full and explicit, and all bonds must be registered and *certified* by the Secretary of State. Sections 10 and 12 provide penalties for disobedience. An officer making any false statement is liable to 15 years in the penitentiary.

[It will be observed that the vicious nature of this law is due, not to the introduction of evil primary principles, but to the crude attempt to accomplish impossibilities. The whole fabric is based on the false assumption that the value of a railroad is always a stable quantity and that a commission of three politicians, or farmers, or other men, can justly estimate that value. We can agree, in a general way, that this law does not encourage railroad building, but we do not know of any way for our friend to immediately convince his law-makers of its chilling effect, except by practical demonstration. He will have to admit that if the state railroad commissioners were possessed of ideal wisdom and omnipresence they could administer this law without hardship; but he probably cannot convince the legislators that the commissioners are not thus all powerful.—EDITOR RAILROAD GAZETTE.]

The Responsibility of the Civil Engineer on Railroads.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Strange as it may seem to the public, and especially to the dealers and investors in railroad securities, who are accustomed to charge all their losses in these stocks and bonds to the incompetency, the carelessness or the wickedness of directors and presidents, it is, nevertheless, true that the great shrinkage of value of railroad properties and, pre-eminently, the recent failures of the Philadelphia & Reading, of the Lehigh Valley and of the N. Y., L. E. & Western railroad companies is due directly to bad engineering. I class the Lehigh Valley among the failures because it is notorious that that company would have failed independently of the Reading had not the coal combination, made some 18 months ago, linked its fate with the latter corporation.

By bad engineering I do not mean the bad execution of engineering schemes, the faulty construction of roadbeds, of bridges and buildings, or of any of the many structures that constitute, physically speaking, the railroad, but I do mean the erroneous conception of the scheme itself, the faulty reasoning that led to its adoption and the unsophisticated or selfish ignorance that led to its execution.

The late Mr. John C. Trautwine long since defined good engineering as "Common sense technically trained." This technical training can now be had in many a good college, and most of the graduates from such schools, after a few years' practice, are perfectly able correctly to design large bridges and roofs, to construct railroads and to do with credit other works as far as they depend upon purely technical knowledge.

There is, however, an enormous difference between properly designing and executing a given piece of engineering work and properly conceiving it and its necessity, its *raison d'être.* Here the common sense, sustained of course by honesty of purpose, plays the important part; and this common sense, which means good sense, unfortunately can not be taught at schools. One is either born with it or must acquire it by weary years of study and practice, and to make it tell in the affairs of life it must be used without fear and often with self sacrifice.

The great majority of railroads, at least all the larger and more important ones, have chief engineers of more or less ability, and they are generally more or less consulted as to the advisability as well as to the plans and cost of proposed enlargements or improvements of the system under their charge. Nevertheless perhaps not one of them will consider himself at fault in the conception of alleged improvements if they turn out badly, but will lay the blame on his superiors and look upon himself as the humble and helpless instrument of execution. Poverty and fear of losing his position often warp the judgment of an engineer or cause him to be silent when he should speak, and make him sacrifice his independence at the cost of his reputation. But sometimes it is the commercial spirit that forces a good engineer to execute a bad scheme, especially if he should happen to be a free lance, and not permanently attached by a salary to any corporation; he then only considers the work itself and the money it brings him, and does not care a straw about its real merits.

It is true that engineers are frequently called upon to carry out great works without being first consulted as to their ultimate financial success or public good, and it would seem to many of them rather quixotic on that account to refuse to have anything to do with the work; and yet it is within the power of every mature engineer on any railroad, by the use of common sense mixed with a little tact and moral courage, if not to prevent some extravagance, at least to prevent foolish waste.

The sudden bankruptcy of the Philadelphia & Reading Railroad Company and the return of its valuable property to the Receivers is a conspicuous case in point. All the financial disaster that has followed the late management of that company is due primarily to bad engineering, when taken in the broad and true sense of that term.

The construction at an enormous cost of the Philadelphia, of the Allentown and of the Harrisburg termini, together with their connecting lines; the acquisition of the Poughkeepsie Bridge and the railroads leading to it, together with the attempt to control prominent and extensive lines of railroads in New England, involved one and all, and above everything else, complicated engineering questions seasoned with no more commercial consideration than every engineering problem carries with it.

The magnificent passenger station of the Philadelphia & Reading Railroad at Twelfth and Market streets, Philadelphia, was put there apparently for no other reason than to outdo its rival of the Pennsylvania Railroad; to have a larger and more lofty train shed; a more commodious and more costly building; to land all its trains a few blocks nearer to the ever-shifting centre of the city, and perhaps, also, to satisfy the vanity of the projector. But meanwhile this same Pennsylvania Railroad Company, even before the great terminus of the Reading is finished, is actually building a train shed many feet larger in span and higher and longer, and it is enlarging its station to such an extent that the Reading will after all again be forced to take second place.

In selecting the location of this terminus everything was sacrificed in order to get to Market street. The continuity of the lines of the Reading Railroad through Philadelphia in connection with the Baltimore & Ohio Railroad and the many advantages inherent to that condition were entirely ignored; the eventual and necessary separation of all these lines from the numerous grade crossings of streets was hardly touched upon, and the prompt and economical handling of trains and provision for future enlargements were apparently never considered. The fact of the matter is, so I am credibly informed, that the site of this terminus and the line leading to it was selected by a real estate agent, and all the properties were bought before an engineer was called in for assistance. Of course it was then too late to protest and the engineer was obliged to make, and did make, the best of it.

The Allentown terminus was built at the instigation and for the almost exclusive benefit of the Central Railroad of New Jersey, and I believe that company did pay one half of the cost. At the time of its construction the rivalry between the Reading and the Lehigh Valley railroads was very acute, and the latter company also built at enormous cost an elaborate passenger station at Allentown to the great delight and profit of that thrifty borough. Of course since the consolidation of these two railroads one of these stations has become useless to the Reading.

The object of the so called Harrisburg terminus, including an expensive bridge over the Susquehanna River, is past finding out; it is nothing more or less than wanton and ignorant waste of money.

If the late President of the Philadelphia & Reading Railroad had made himself familiar, by consulting impartial experts, with the geographical position of the Poughkeepsie Bridge and with the characteristics of the railroads leading to it, he would probably never have entered into his New England enterprise, and unfortunately he had no officer under him who dared, if he knew better, to point out the impractibility of the whole scheme. It seemed at first that this bridge, if of any use at all to railroads, would be most valuable to the New York, Lake Erie & Western as a connecting link between it and the New York & New England, and especially so as these two companies had for years interchanged a large and increasing traffic by means of a ferry across the Hudson at Newburgh.

The Erie company did, therefore, make a thorough investigation of the merits of this new route to New England, but it was forced to abandon the idea on account of the adverse and heavy grades of the roads leading to the bridge, and on account of the large interest charges on the great cost of the bridge itself and of its railroads, which made cheap transportation and competition with rival lines better located impossible. The lease of the Poughkeepsie Bridge naturally led the Reading to the attempt to control the New York & New England and the Boston & Maine railroads, but since the lease was bound to be (and has now proved to be) unprofitable, the last attempt was very properly abandoned by the Receivers.

These cases cited do by no means constitute all the mistakes made in spending vast sums of money on expansions and so-called improvements without adding one dollar to the revenue of the company; but they are the most conspicuous. It may therefore be said with perfect justice that this last failure of the Philadelphia & Reading Railroad Company is due primarily to bad

engineering; of course commercial recklessness considerably expedited the catastrophe. And it makes no difference to the position taken whether the bad engineering was done by the President himself or by the advice of his subordinates or outside parties: the fact remains that an experienced and able railroad engineer—who must be familiar with transportation matters to be able and experienced—could have avoided this great disaster if his advice had been asked, or he could have warned the owners of the property if he had their confidence in the degree to which his position entitled him.

The causes that have brought about the great distress if not absolute failure of the Lehigh Valley are almost exactly of the same nature as those that have ruined the Philadelphia & Reading, but they are more directly traceable to the engineering department of that company, and they have been if possible more disastrous in their results, because the mistakes (to put it mildly) of the Lehigh Valley Company are directly responsible for the recent failure of the New York, Lake Erie & Western which was again forced into the hands of receivers in spite of its honest and able and thrifty management.

Like the Reading, the Lehigh Valley Railroad Company was prosperous and without trouble as long as it was content to remain a local road carrying large quantities of anthracite coal, and earning large dividends on its stock. But again, like the Reading, it also became ambitious as it grew in wealth, and started without hesitation on its career of expansion, and did so by the advice of an able engineer who has for years been a prominent figure in its council. It quarreled with the Central Railroad of New Jersey and as a consequence built its own line to New York Harbor, first to Perth Amboy and then to Communipaw.

Not satisfied with this important extension of its main line, which was perhaps justified, and with its extensions into the Northern or Wyoming coalfields, the Lehigh Valley Railroad Company soon afterward began to look longingly toward Buffalo as its ultimate Western terminus, and about a year ago it actually finished and opened for traffic its own line to that important lake port. This consummation was the straw that broke the camel's back, and that enterprise obliged that once so prosperous a company to sacrifice its independence and forced the Lehigh Valley Company into the hands of the Reading with the very vague idea that two minus quantities would make a plus.

Previous to the construction of this line to the Lakes the New York, Lake Erie & Western had carried for many years, with mutual profit to both companies, over its lines between Waverly and Buffalo, and the bridges over the Niagara River, all the Western traffic and especially the coal shipments of the Lehigh Valley Railroad; and it might do so to-day, without any embarrassment to its own traffic, and with both companies in a solvent and independent position, if the very liberal offer for the use of its tracks made by the Erie company in 1890 had been accepted by the officers of the Lehigh Valley. But all efforts and concessions on the part of the Erie management to retain the traffic of the Lehigh Valley Company proved useless. The ambition to build an ideal railroad got possession of the Engineering Department of the Lehigh Valley, and completely overclouded their reasoning and judgment; and the general desire of all operating officers to have their own railroad to everywhere aided and abetted this ambition, and the deed was done. No one knows better now than these same engineers and officers how sad a mistake they made, and far be it from me to aggravate their sorrow. "*Errare humanum est.*"

CHIEF ENGINEER.

Wootten Boiler, with the Belpaire Top.

The illustrations show a modification of the well known Wootten boiler intended to reduce the frequency of broken staybolts. This boiler, with the Belpaire top, has been designed by Mr. J. Snowden Bell for the Wharton Railroad Switch Company, of Philadelphia, which owns the Wootten patents. It has several excellent features, not the least of which is the increase in the width of the water leg from the bottom to the top; the width at the bottom is 3½ in., and the top 6 in. The screw stays are practically perpendicular to all sheets. The longitudinal stays for the back head are made after the Wightman patent, commonly used at the Pittsburgh Locomotive Works, and consist of a rod with a right and left hand screw connection at the ends.

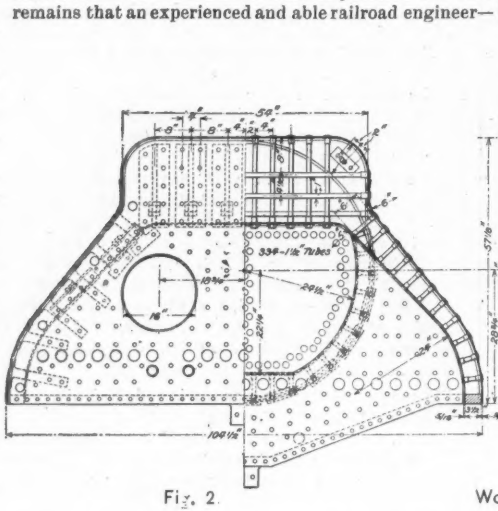


Fig. 2.

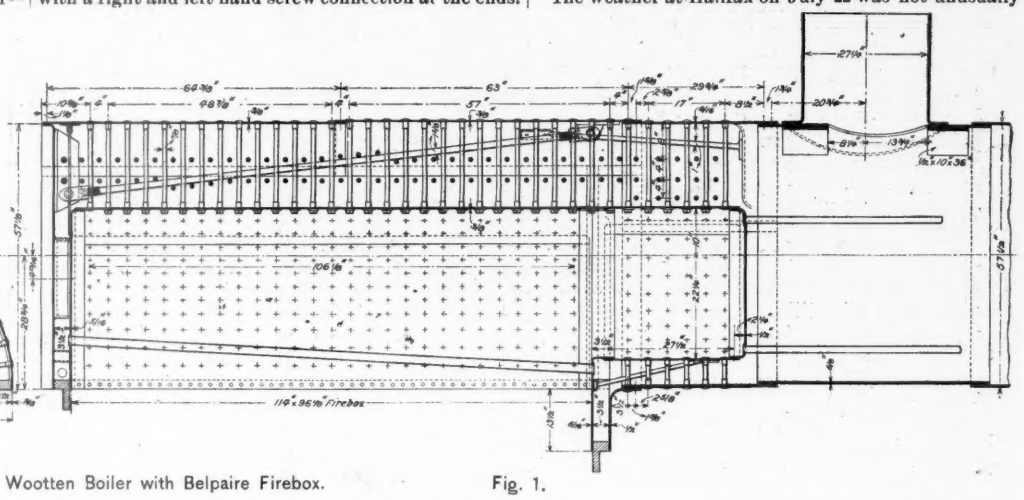


Fig. 1.

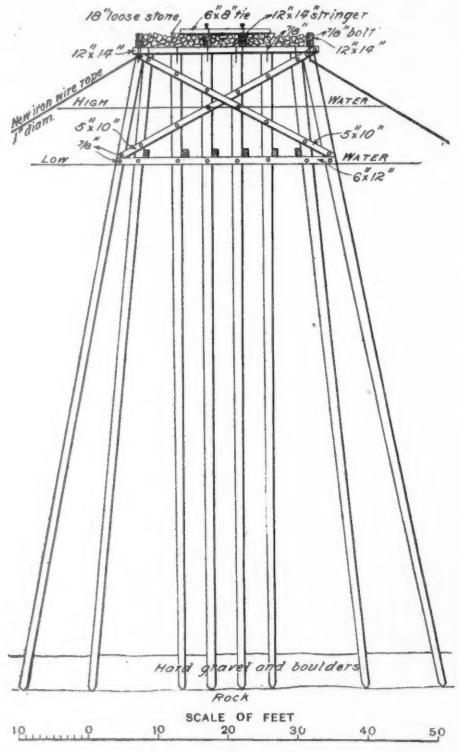
Wootten Boiler with Belpaire Firebox.

The back head is stayed by strap stays, as shown in fig. 2, and the front sheet of the firebox is stayed by a diagonal stay, as shown. The flat place, common to Belpaire tops, where the waist commences, is stayed as usual by a diagonal stay to the top sheet.

We had occasion recently to look up the service performed by the Wootten boiler, and found almost unanimous approval of the action of the boiler in regular service. The efficiency of the evaporation with poor coal, and the enormous capacity of the boilers, make them a very useful type. This is also true of the experience with a similar boiler without the combustion chamber which is used in Belgium.

The High Trestle at Halifax.

In our issue of July 28 we gave a brief account of the wreck of the long trestle on the Intercolonial Railway at Halifax, N. S., on July 23. It appears that the trestle which has been in use since 1891, and a part of which has just been carried away, was not like that originally built, and which was described in the *Railroad Gazette* of April 9, 1886, but was an ordinary pile trestle, and we publish herewith a cross-section of one of the deep-water bents, showing the style of the bridge. It will be seen that the piles, which were of hemlock, were about 95 ft.



Deep Water Trestle, Intercolonial Railway, Halifax, N. S.

long, driven into the gravel bottom of the harbor about 5 ft. The bents were 12 ft. long from centre to centre. The bridge was weighted with stone as shown in the cut, and was anchored by iron guy ropes 1 in. in diameter, fastened about 150 ft. either side of the bridge to cages made of old rails filled with stones and weighing about 15,000 lbs. each. In the more shallow portions of the harbor the bridge was anchored with lighter weights.

The use of piles, instead of the former device of anchors at the foot of each leg, was decided upon in 1891, because it was important to put the railroad in operation at the earliest possible moment, and the structure was regarded as temporary at best.

The weather at Halifax on July 22 was not unusually severe, but the bridge was carried away in the night, and, although the evidence is meagre, it seems that there must have been something in the nature of a hurricane. One bent was moved nearly three-quarters of a mile with the two 15,000-lb. anchors attached to it. Most of the anchors held to the piles, and the floor was carried off by the force of the waves. The length of structure carried away was about 675 ft.

The Extension of the Broad Street Station of the Pennsylvania Railroad, Philadelphia.

In the *Railroad Gazette* of June 9 was published a detailed description of this work, with plans, elevations and details, and with an inset showing numerous photographic views of the work from various points and in different stages of its progress. We now present several views of portions of the work in its later aspects.

It will be remembered that when the erection of the new one-span roof proceeded beyond the western end of the old roof of four short spans, the arrangement of the traveler shown in fig. 7, page 407, required material modification. The three inner frames of the traveler had previously rested upon trucks running upon three elevated tracks carried by double lines of timber posts. These posts were bolted to the iron columns supporting the trusses of the old roof, and depended upon them for their lateral stability. But upon leaving these supports behind it became necessary that these three inner frames would be so constructed as to contain their own provision for lateral stability. They were accordingly spliced out to such a length as to reach down to the train floor (the trucks, formerly elevated, being brought down to the track level) and securely braced, by diagonal and horizontal timbers, to the upper portion of the frame work of the traveler, as shown in fig. 27, which represents the traveler standing (on June 19) in position to receive arches Nos. 15 and 16. The view is taken from near the old Seventeenth street tower. See plan, fig. 1, page 406. Fig. 28 is a nearer view of the traveler in the same position, but embracing only three inner frames, in order to show the arrangement more in detail.

The last or westernmost roof-truss, or arch No. 20, was erected July 3, and the removal of the traveler is being completed at the present writing (July 22).

In fig. 29, showing the northern foot of the traveler, with the bottom section of arch No. 16 in position, the lower-chord members for the lower three panels (between joints Nos. 21 to 27 inclusive, see fig. 3, page 407) is seen in position upon the traveler.

In glazing the roof an experiment will be made with the new material known as "wire-glass," and manufactured by the American Wire-Glass Manufacturing Co., of Tacony, Philadelphia. This material consists of glass rolled in plates with wire netting imbedded in it. In the manufacture, a quantity of the glass is brought from the furnace in ladles and poured, in a semi-fluid condition, upon a smooth iron bed, whereupon the rolling machine is passed once over it and the glass plate is left behind, with the netting imbedded. The rolling machine is provided with three rollers. The first one, which has a smooth cylindrical surface, reduces the glass to a plate of approximately the desired thickness. The sheet of wire netting, fed into the machine, is then laid by it upon the upper surface of the glass plate, and at the same time the second roller, which is corrugated, passes over both the plate and the netting, the corrugations driving the netting down into the glass and leaving ridges of glass between the valleys produced. But the third roller which, like the first one, has a smooth surface, immediately follows and flattens out the ridges left by the second roller, spreading them over the intervening valleys and over the wires in them, thus leaving the plate with a uniform surface and with the wire netting imbedded in it. The object of this device is, of course, to prevent injury which might be caused by the

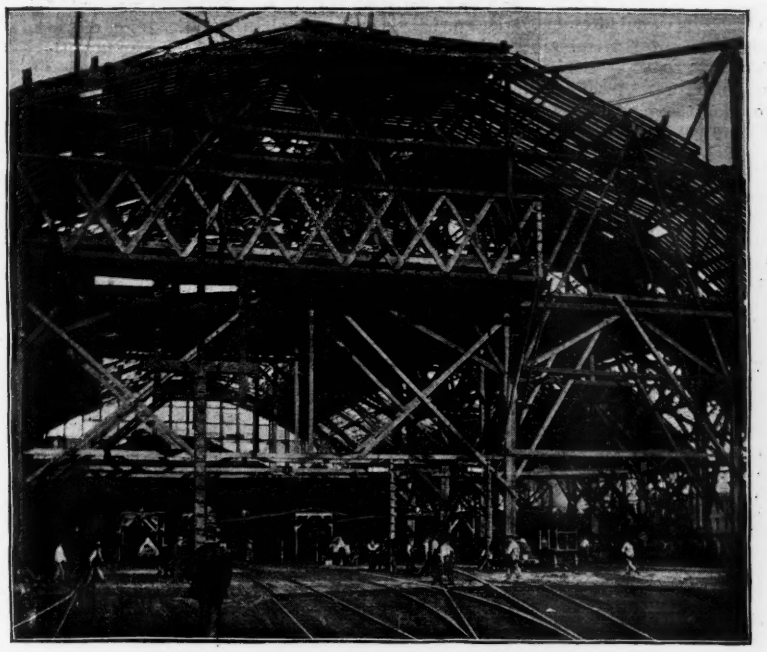


Fig. 28.—Three Central Frames of Traveler.

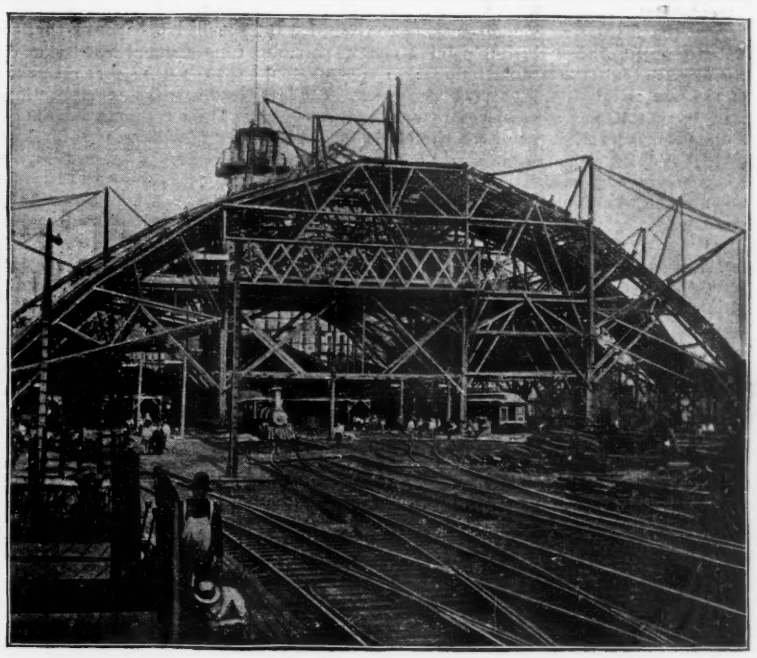


Fig. 27.—Traveler in Position.

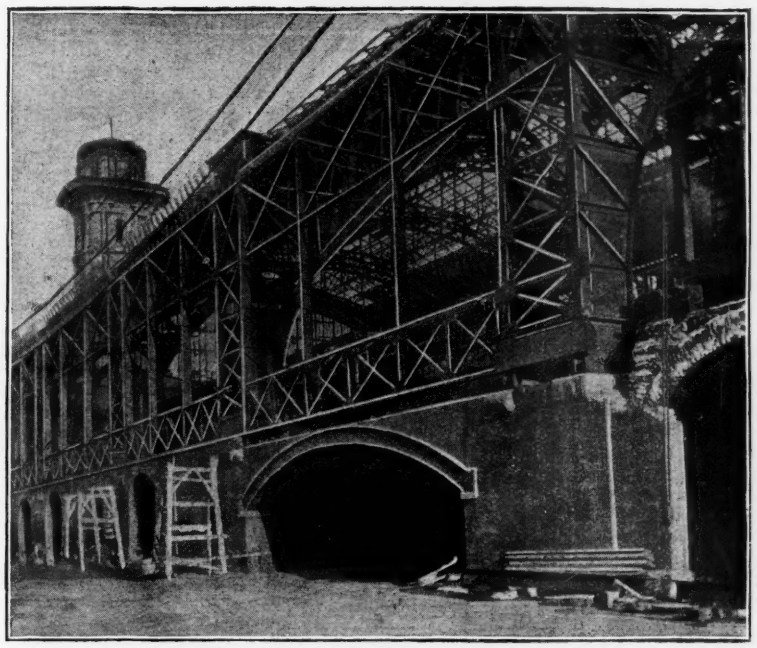


Fig. 31.—North Side of the Work, with Arch Over Sixteenth Street.

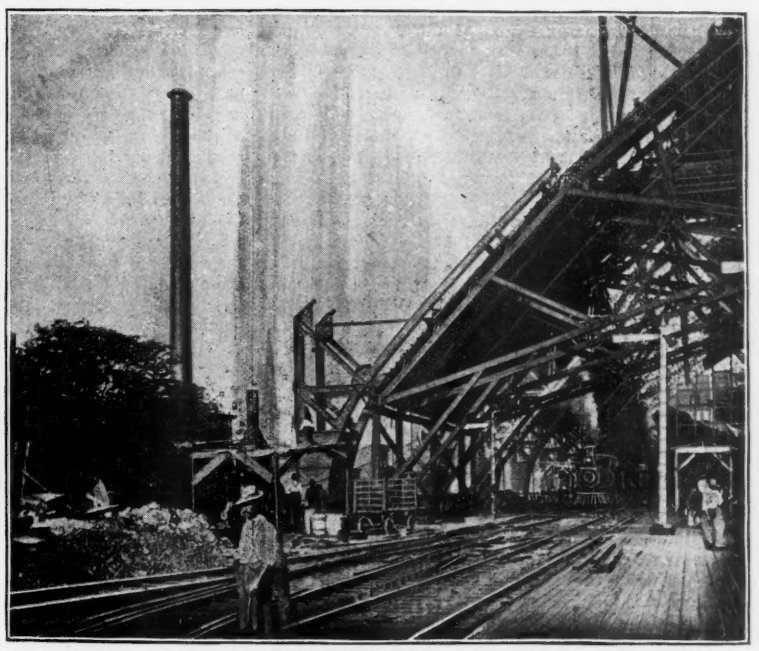


Fig. 29.—North Foot of Traveler, with Bottom Section of Arch No. 16.

ENLARGEMENT OF BROAD STREET STATION, PENNSYLVANIA RAILROAD, PHILADELPHIA.

falling of large pieces of ordinary roofing glass in case of the fracture of a light; and it remains to be seen whether in this respect it is superior to ordinary glass plates with separate wire netting placed beneath them.

Fig. 30 shows the heavy triple-plate girder described on page 405, upon which is being built the south wall of the extension of the head-house over Fifteenth street. As already stated, the span is 53 ft. 1 in., depth 10 ft. 6 in., and weight 110,780 lbs. Other dimensions will be found upon page 405.

Fig. 31 shows a portion of the work on the northern or Filbert street side, looking southeast from a point just west of Sixteenth street, and showing the 50-ft. brick arch over that street. This arch and the brick wall east and west of it form a part of the old construction. The wall, however, as already explained, is heavily reinforced at those points, where the arches of the new roof construction are supported.

The Second Decade of the Massachusetts Railroad Commission.

BY WM. A. CRAFTS, CLERK TO THE COMMISSION.

(*Continued from page 552.*)

THE WORK OF THE COMMISSION.

Judge Russell, as Chairman, directed the work of the Board, and except in certain details of investigation and inspection practically performed it. As previously observed, he considered the various questions that came before the Commission in their legal aspects, and he made some very able reports in which the bearing of statute or common law on the matters under consideration was fully discussed.

In one important matter he differed with his predecessor. When the general railroad act for the incorporation of railroad companies was passed, in the earlier years of the Commission and by its influence, it was believed by its framers that nothing more was required to prove the exigency for a new road than the readiness of parties to subscribe for the stock, which was fixed at a certain sum per mile, and pay in ten per cent. of such subscription. The fact that responsible parties were ready to invest their money in such an enterprise was held to be sufficient evidence that public necessity required the construction of the road. Several cases however, occurred which made it evident to the Board, that some change in the laws was advisable. In one case three different associations were formed to obtain charters for constructing a beach railroad on substantially the same route. Not being able to agree with the selectmen of the town upon a route two of the associations appealed to the railroad commissioners under a provision of the law that if the directors could not agree with the municipal authorities upon a route they could appeal to the Board, which "shall hear the parties and fix the route." This provision was evidently intended to meet the case of a disagreement as to some portions of a route. But here were two parties who according to the law had each established an exigency for its road by adequate subscriptions for the stock, and each claimed that the Board was by the law required to "fix the route" for its road. The Board admitted that such was the law, but hesitated to act and eventually some arrangement was made between the rival associations to unite their enterprises.

In another case four associations were formed to obtain charters for the construction of elevated railroads between Boston and different parts of the suburbs. They each had the requisite subscriptions for stock per mile, and not being able to agree upon their respective routes with the municipal authorities, they appealed to the Board. After one hearing the petitions were severally dismissed upon a technical non-compliance with the law. They afterwards applied again, and having been previously told that the Board could not fix a route upon a street already dedicated to a public use and certainly not without liability to consequent damages, they asked for a location alongside of the streets, but realizing the cost of a location that involved the destruction of costly buildings and ancient land marks, they withdrew that request and left the question of routes to the decision of the Board. Of course the scheme was bitterly opposed by the owners of real estate, and after pointing out the probable cost of the ill-considered plans the petitioners were informed that if they still desired the Commission to fix the route it would be compelled under the law to do so. The more prudent of the associates apparently called a halt, for the petitions were not pressed.

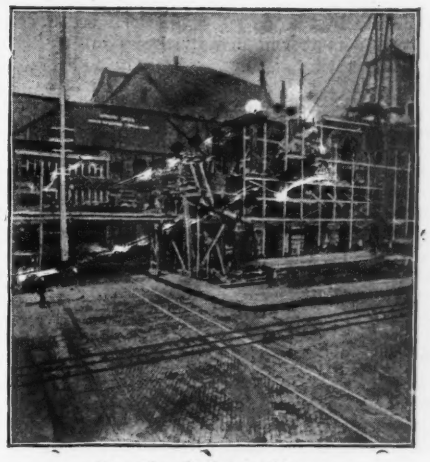


Fig. 30.—Girder in Place.

With these two cases for illustration, Judge Russell made an able and earnest argument before a committee of the legislature in favor of establishing some tribunal to determine the exigency for a proposed road before application should be made for a location. The change was opposed by the framer of the original law and by others, including Mr. Adams, and no new law was

passed. But the following year, with stronger arguments, the legislative committee was convinced. In this argument Judge Russell pointed out the possible result of the existing law, as follows: "The statement of the law, as it exists, is the best argument. The law now is, that if any man wishes to construct a steam railroad through the heart of the city of Boston, he has a right to do so, although the city authorities are unanimous in opposing it, although every citizen of Boston opposes it, and although the Commissioners, who grant the route, believe that it is needless, and that it will produce vast injury and no good.

"I say one man can do this. There is a vague idea that there is some virtue in the provision of law requiring 25 associates. But the one man with capital may join with him 24 others—his workmen, his clerks—taking care that they have the money to pay for one share each. This is no imaginary case, and under law it was rightfully done."

A bill was accordingly passed providing that an association projecting a new road, before obtaining a location, shall apply to the Board of Railroad Commissioners for a certificate that public convenience and necessity require the construction of such road; and after public notice and a hearing such certificate may be granted or refused. The law applies also to extensions and branches of roads already constructed. The same law also provides that before obtaining a charter the petitioners must show a sufficient amount of the capital stock paid in to meet the estimated land damages.

The law has worked well, and as administered it in one case at least prevented an improvident expenditure out of sheer rivalry on the part of a company not financially strong, while it secured railroad facilities to a larger public by the extension of a branch of another prosperous road. It has also, doubtless, prevented the formulating of schemes of questionable expediency.

When the regulation of railroads crossing state lines, by Congress, under its constitutional authority to regulate interstate commerce, was first agitated, Judge Russell considered it of doubtful expediency, and in the Annual Report of 1882 argued against it at some length.*

The following year a case of interstate commerce came before the Commission. Since 1872 the Massachusetts statute forbidding a higher freight charge for a less distance from the same point of departure in the same direction than is charged for a greater distance has been in force. Under this law a complaint was made that the New York & New England Railroad charged a higher rate for carrying coal from Norwich, Conn., to Webster, Mass., than it charged for carrying ing it to Worcester. This was, of course, interstate commerce, but Judge Russell held that the Massachusetts law governed this case. The decision was based mainly on a decision of Chief Justice Waite, of the Supreme Court, sitting as circuit judge, in a similar case, that in the absence of any law of Congress regulating interstate commerce a state law regulating long and short haul rates applied. The railroad company complied with the order of the Board and made the same rate to Webster as to Worcester, though subsequently the United States Supreme Court (three justices dissenting) overruled the decision of the Chief Justice, and practically revoked the decision of the Massachusetts Commission.

Subsequently another case in which interstate commerce was involved came before the Commission. On complaint of a number of manufacturers in Berkshire County, after a hearing, the Board recommended to the Housatonic Railroad Company a reduction of certain rates, including those on freight, between points in Connecticut and points in Massachusetts. The railroad company declined to comply with the recommendation, and the aggrieved parties went to the legislature and secured the passage of a law authorizing the Railroad Commission to fix the rates. The Board never coveted such authority, preferring to accomplish reforms by force of argument and public opinion. But the Housatonic Railroad Company was a foreign corporation, operating Massachusetts roads under leases, and was not disposed to regard the recommendations of a Massachusetts commission or Massachusetts public opinion, and it was necessary that the authority of the state should be invoked. Under this law, after a further patient hearing, the Board ordered a reduction of rates, as previously recommended, including those on freight between Connecticut points and Massachusetts points. The company still failed to comply, and the matter was referred to the Attorney-General, who brought a suit to enforce the penalty provided by the act. The case went to the Supreme Court of the state who decided that the act so far as it affected intestate commerce was unconstitutional and to that extent the order of the Board was void. Judge Russell, while admitting that the decision of the state court, restating that of the Supreme Court of the United States, was conclusive, believed that these decisions would hasten congressional legislation on interstate railroad traffic, then urgently advocated, which he thought would lead to serious complications and unfortunate results.

These cases are mentioned to show the kind of questions which came before the Commission at this time, and were discussed in the more elaborate reports. Judge Russell was eminently judicial in temperament and by habit. He liked to hear evidence and the arguments of counsel and to discuss points of law, and he was very quick to apprehend all important facts bearing on a question under consideration. He was clear and decided in his exposition of the legal rights, both of individuals or communities and of railroad corporations; but in matters of railroad policy or practice he deferred to the opinions of those managers in whom he had confidence unless they conflicted with well settled principles of law.

Among a different class of cases between individuals and the railroads was a complaint of certain sleeping-car passengers from Chicago to Boston. When they arrived at Fitchburg, 50 miles from their destination, the sleeping-car was detached from the train and they were told they must proceed in an ordinary coach. To this order they naturally and justly demurred and made complaint to the Board, which in its decision used the following language:

"The counsel for the railroad company doubted whether the Board had any jurisdiction . . . because the acts complained of are not done by the company, but by a foreign corporation not a railroad company. But the Board has *general supervision of all railroads* in the state, and is bound to learn *the manner in which they are operated with reference to the security and accommodation of the public.* Such jurisdiction cannot be evaded by transferring the operation of the road, or any part thereof, to a foreign corporation. No corporation has either the right or the power to part with the control of the rolling stock used thereon; nor should any railroad company deprive itself of power to fulfill the promises made by its advertisements. The managers of the Fitchburg Railroad claim that the parties in charge of the Wagner cars have absolute control over those cars while forming part of a train—control so complete that the conductor of a train is bound to obey any order which the conductor of a Wagner car may choose to give as to the disposition of that car. If this were so, the Board would feel bound to censure the contract which abdicated the just and necessary powers of a corporation operating a Massachusetts railroad, and gave up the authority necessary to protect the public."

This decision had a good effect on the arrangements between the railroad companies and the car companies, and assured the rights of the traveling public. In all complaints or petitions the questions at issue were discussed with like force, and the rights of either complainants or railroads equally maintained.

The numerous accidents, fatal and otherwise, to railroad men when coupling or uncoupling freight cars had at last aroused a strong public sentiment in favor of some means to lessen these casualties by avoiding the necessity for going between the cars in the performance of that duty. From 1881 to 1885 the Commission earnestly advocated some measure to require the adoption of safety couplers. In 1883 a bill designed to accomplish that purpose failed of enactment, but in 1884 the Massachusetts Legislature passed a law requiring that all new freight cars owned by Massachusetts roads and all such cars when repaired with new drawbars, shall be equipped with automatic or safety couplers prescribed by the Board of Railroad Commissioners after an examination and test. This brought a swarm of inventors or their agents before the Commission, and at a public examination more than 200 couplers of various degrees of merit or demerit were exhibited in models and claimed to be each a perfect safeguard against accidents by coupling or uncoupling cars. A few were prepared for tests and were tried with more or less success on a small scale. In accordance with the act, after the examination and test, the board, with little faith in the result, prescribed five automatic couplers for use on Massachusetts railroads, only two of which were of the vertical hook type. In their report the Commissioners recognized many of the difficulties attending the adoption of any safety coupler, and the inutility of the several states prescribing couplers for use by their respective railroads, but hoped that such action would bring about a general agreement of the great railroad corporations of the country, through the Master Car Builders' Association, for the adoption of a universal coupler.

Some of the unsuccessful applicants for approval secured in the following year legislation requiring biennial examinations and tests of couplers. Under that act two or three more couplers were prescribed, and then the matter was practically remanded to the railroad companies by the Board approving for trial any couplers which a company desired to use. After the passage of the interstate commerce law the coupler question took on a new phase.

In 1887 Judge Russell, whose health had failed for some months, died, and Hon. George G. Crocker was appointed in his place and chosen Chairman of the Board. Though he had not made a special study of railroad affairs, Mr. Crocker had a general knowledge of the financial and physical condition of the railroads of the state, and was disposed by application to master the various questions coming under the jurisdiction of the Board. By inclination and training he was an investigator, inquiring minutely into details. In considering the questions coming before the Board on complaint or petition he inquired into all facts on either side of the matter at issue, and in the investigation of accidents he sought to ascertain the remote as well as the immediate cause. With a stronger taste for mechanics than his predecessor he examined with interest all appliances designed to promote the safety of employees, passengers and the public, methods of construction and character of equipment, in all such matters seeking information from experts.

Soon after Mr. Crocker's appointment the Board was called upon to investigate the Bussey Bridge disaster. The Commissioners were early at the scene of the accident, and examined on the spot the broken hangers which were the immediate cause of the accident, and directed that they should be preserved for evidence at the formal investigation. An enterprising representative of a technical journal, however, secured them, and, taking them to New York and representing them by photogravure, claimed to have discovered the cause of the accident. When the Board learned what had become of these pieces of important evidence, their return was demanded. The investigation by the Board was not simply to ascertain the circumstances of the accident, the number of killed and wounded, and the immediate cause of the bridge going down; the inquiry was conducted with a view of ascertaining the history of the bridge, whether the accident was due to defective material, poor construction or faulty design, whether the management had exercised proper care in selecting the design of the bridge and due watchfulness of its condition; whether, being sufficient for the traffic of the road at the time it was built, the weight of rolling stock had been increased for a larger traffic without regard to the greater strain on the bridge; whether there were guard rails or timbers, and the ties were sufficiently close; and various other matters bearing more or less remotely on the general question of proper bridge inspection.

This disaster and the facts developed by the investigation somewhat alarmed the Commission as it did also the public. When one member of the Board was a civil engineer he had given much attention to the examination of bridges, but even then there was no regular system of proper supervision. When the constitution of the Board was changed, examination by experts was made only in special cases. The Board now recommended immediate legislation to require careful and frequent inspection of all railroad bridges, and the employment of a competent bridge engineer to supervise this work. An act was promptly passed for this purpose, and the Board appointed Mr. George F. Swain, a professor in the Massachusetts Institute of Technology, and a thoroughly competent engineer, to take charge of the supervision of bridges. Under this law and the direction of the engineer the Board obtained a complete description of every railroad bridge in the Commonwealth, its design, material, construction and its history, together with plans upon a prescribed scale and a strain sheet. The details of these plans and strain sheets are carefully reviewed by the bridge engineer and the companies notified of any defects or errors discovered. The companies are required to have examinations of their bridges made not less frequently than once in two years by competent experts, whose reports are transmitted to the Board. The bridge engineer also makes personal examinations of the bridges as often as practicable, and reports thereon to the Board with such suggestions of repairs or improvements as he deems advisable, and copies of these reports are transmitted to the companies with a request that the suggestions be promptly heeded; and it is known that such suggestions are generally followed. In two years after the fall of the Bussey Bridge the system was fairly complete, and it may safely be said that the official supervision of railroad bridges and the care taken to make them safe is equal to that of any other state of the Union.

The Quincy catastrophe on the Old Colony Railroad in 1890 was investigated with the same thoroughness that characterized the investigation of the Bussey Bridge disaster, the inquiry being directed not only to the patent and latent circumstances of the accident, but extending to the brake power on this and other passenger trains, the rules governing section men when repairing track, on this and other roads, in and out of the state, the mechanical construction of the Barrett track-jack, which makes it difficult to release upon sudden emergency, and other facts bearing remotely on the accident. In its report the Board made this accident the occasion for recommending to all the roads the equipment of passenger trains with the most efficient brake power possible, more careful rules as to the use of track-jacks and the signaling of trains, and as to the duty of section masters. In all investigations of accidents it has been the purpose of the Board to make inquiries and draw conclusions which would be useful to all the roads. In this way, and on all proper occasions, it has endeavored to arouse the railroad managers to a realization of the importance of a higher standard of equipment and roadbed.

[TO BE CONCLUDED.]

*At the time this report was written (1881) the proposed regulation of interstate commerce had not taken any definite form, and some of Judge Russell's arguments do not apply to the interstate commerce law as finally enacted. It was mainly the evils which might arise from the assumption by Congress of direct regulation of interstate commerce and the fixing of rates that he feared and pointed out. Though the law now in force does not place regulation directly in Congress, it is by no means impossible, in view of the freaks of political organization and insane economic ideas we have seen manifested in some portions of the country, that Congress, having once exercised its constitutional power, may undertake to fix rates and regulate railroad operation for the benefit of certain sections and certain interests.

Compound Locomotive for the Lake Street Elevated.

It was noticed in the *Railroad Gazette* last week that the Lake Street Elevated Railroad Company, of Chicago, would use in the operation of its road a number of compound locomotives built by the Rhode Island Locomotive Works after the patents of the late Mr. C. H. Batchellor, whose system was described in the *Railroad Gazette* of Dec. 11, 1891. The Rhode Island works are, as is well known, the pioneer builders of compound locomotives for elevated service, having put in operation in 1890 two compound locomotives on the Brooklyn Elevated road. The report of a test between one of these engines and a simple locomotive identical in all respects, except in the parts affected by and controlling the steam distribution, was given in the *Railroad Gazette* of Jan. 9, 1891.

The compound system of the Rhode Island Works uses an exhaust valve by which the exhaust from the high-pressure cylinder can be turned into the stack; also an intercepting valve located near the low-pressure cylinder and so designed as to permit steam from a small branch pipe, in certain cases, to pass through at boiler pressure to the reducing valve. This allows steam to pass into the low-pressure steam chest at a reduced pressure, which, as compared with boiler-steam pressure is inversely proportional to the ratio of piston areas.

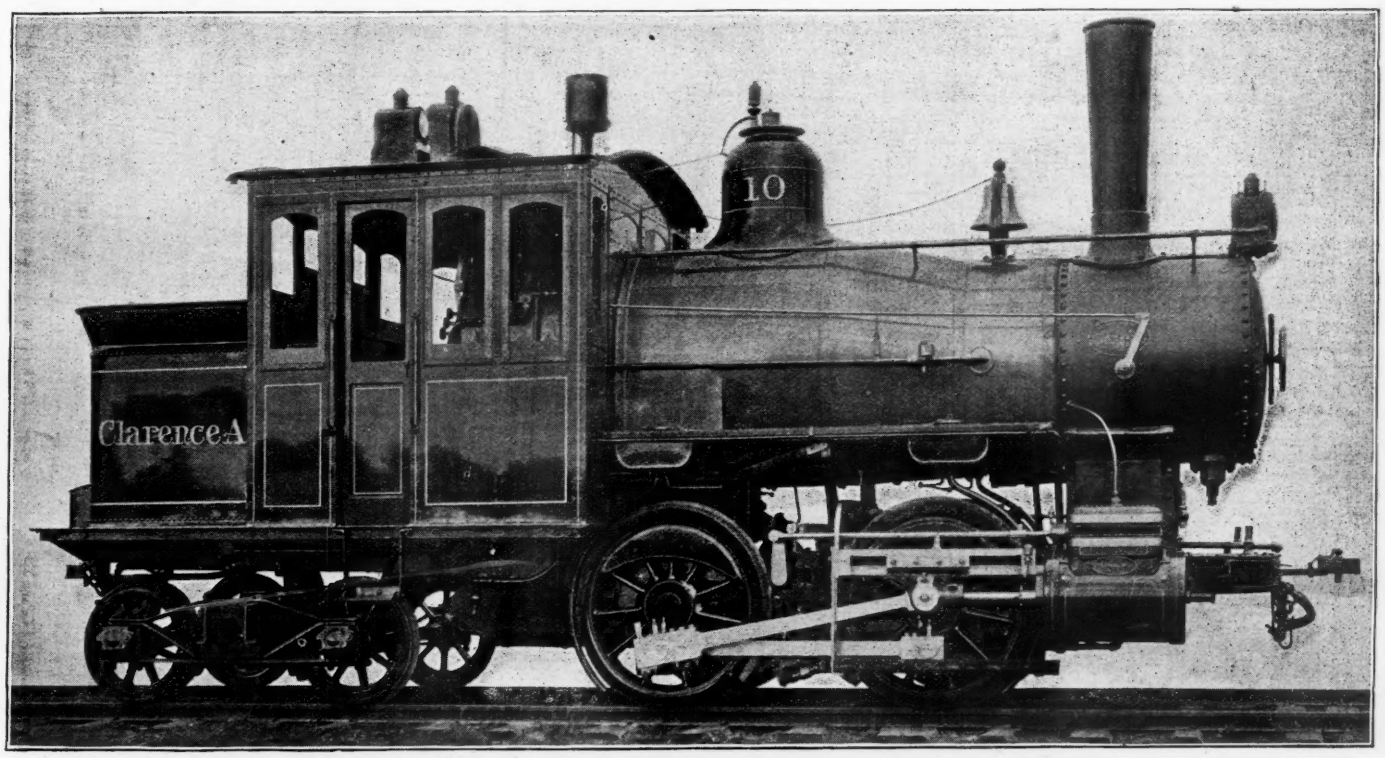
The construction is such that steam is automatically admitted to the low-pressure cylinder directly from the boiler at starting, this communication being maintained until the reservoir pressure reaches such a point as to give to the low-pressure cylinder its due proportion of work. The action can, however, be controlled from the cab and the engine run simple as long as desired, or changed from compound to simple at will, or vice versa.

We show herewith a perspective view of one of the engines built for the Lake Street road. The following are a few of the principal dimensions of this engine:

Diameter h.-p. cylinder	13 in.
" l.-p. "	21 "
Stroke	18 "
Diameter of drivers	44 "
Total wheel base	16 ft.
Total weight in working order	60,000 lbs.
Weight on drivers	43,000 "
Weight on truck	17,000 lbs.
Type of boiler	Wagon top, extension front.
Diameter of boiler	44 in.
Thickness of shell	7/16 in.
Steam pressure	180 lbs.
Number of tubes	188
Diameter of tubes	1½ in.
Length of tubes	6 ft. 6 in.
Grate	58 × 42⅝ in.
Type of firebox	Radial stay.
Thickness of side sheets	5/16 in.
" " back "	5/16 in.
" " crown "	5/16 in.
" " flue "	7/16 in.
Fuel	Anthracite coal.

This engine, as will be seen by reference to our engraving, has much in common, so far as general appearance goes, with other locomotives in use on elevated roads. In weight, a slight increase is shown over similar locomotives heretofore constructed.

The main frames are of hammered iron forged solid. The guides are of steel, of the Laird type, and the crossheads of cast steel. The driving wheel centres are 39 in. in diameter fitted with steel tires 2½ in. thick and 5¼ in. wide. The axles are of steel with journals 6 in. in diameter and 7 in. long, the driving boxes of Damascus bronze with wide flanges and heavy brass bearings. The connecting and parallel rods are of steel, forged solid, with straps and keys on the main rods. The side rods are without keys. The engine truck is of the centre bearing swing motion type with side bearings. The truck axles are of steel with inside journals 3¼ in. in diameter and 6 in. long.



TWO-CYLINDER COMPOUND LOCOMOTIVE FOR LAKE STREET ELEVATED RAILROAD, CHICAGO.

Built by the RHODE ISLAND LOCOMOTIVE WORKS, *Providence, R. I.*

Staybolt Inspection and Specifications.

[*Concluded from page 565.*]

We gave last week extended extracts from a valuable report on "Staybolt Inspection and Tests," made by committee of the Southern & Southwestern Railway Club, and presented at the April meeting. Considerable discussion followed on hollow staybolts.

Mr. Gibbs, who has used them since 1885, said that he had noticed that a great deal of this iron cracked longitudinally. He had the experience of sending out engines pretty well fitted with hollow staybolts; that though the staybolts were either broken or cracked, yet they were not leaking, as the sediment had filled up the cracks. He had seen in his own shops cases where they were broken, and the outside had become stopped up. During the last few weeks, at one of the northern clubs, report was made that when bolts broke gradually, owing to a small amount of leaking, the evaporation would leave solid matter, and that the bolt might break off entirely, leaving no indication of leakage outside.

Mr. Sanderson asked if there would not be a spot on the end indicating leaking; to which Mr. Gibbs replied that sometimes, the surface not being kept clean, the ends become greasy and black on the outside.

Mr. Sanderson mentioned the Mannesmann process and said he thought that iron obtained from it would be satisfactory, as none but the best iron can be used in this process. He said the result of these tests showed that it was the best thing to use. He reported a test of a sample sent which, when turned down in the centre, stood 93,600 vibrations.

Mr. Cook's experience was limited, but some ten years ago he had had some experience with hollow stays. They had broken pretty early in the life of the boiler, and had been renewed with solid iron, which gave better service. That was about 10 to 12 years ago, and he supposed that staybolts had been improved since then.

Mr. O'Brien had bought hollow staybolts that looked like a pipe in a pipe. When broken, the fibre was separate and distinct, like one piece of pipe in another.

Mr. Wade had had a quantity of it furnished him which was not welded where it came together. He had some samples that were not welded. By bending a little they showed that they were never welded. He did not know that it operates against the iron, but that was certainly the way it was made.

Mr. Sanderson stated that the recommendations of the committee were made solely on the result of the tests, and that the points brought out by the members were very important, and worthy of consideration. He thought that it was the grade of iron that was had to work up. A uniform grade of hollow iron should be had. He has, during his experience, taken some stays that were broken very short, having coarse crystalline fractures; these when pulled apart showed good fibrous iron, proving that the crystallization was local and did not extend through the whole length of the staybolt.

Mr. Sanderson was asked whether he has noticed any difference in the breakage of staybolts in the radial stayed and Belpaire types of boilers. He replied that his company purchased, in 1883, a number of radial stayed boilers, about 30. The stays in these boilers continually broke in the bend, not at the top or bottom, but right at the bend. They had broken all the way round. He cited a case, when, after allowing the fire to die down a little, on trying to get the engine hot quickly, a dozen or more stays snapped like a volley of musketry. The steam pressure did not vary more than a few pounds, but by getting the fire hot suddenly, the difference in expansion made those stays crack. The Belpaire boilers broke stays commonly at the top rows; sometimes in the front, but seldom in the bend. In the radial stayed form the strain transmitted downward from the crown sheet acted at the bend, due to the arch-like form. In the Belpaire the distortion of the stays from expansion was longitudinal, as is shown by the little line on the fracture, showing the final break of the staybolts. This was usually vertical in this type of boiler, while it was generally horizontal in the other type at the bends. Most of the radial stayed boilers on his road had had two fireboxes since 1883, and some of them had had three. They had bought in 1882 a number of Belpaire boilers and of these but one of the fireboxes had gone, and the loss of this one had been undoubtedly due to mud burning. In explaining the failure of the side sheets above fire line (showing sample), these sheets had to expand, and were resisted longitudinally by the mud ring and outside sheet, and consequently must buckle between the staybolts. Alternate cooling and heating caused them to straighten and buckle like an accordeon, thus causing cracks to start.

In reply to a question as to what kind of water was used, Mr. Sanderson said that on some portions of the road the water was very bad. That limestone scale formed very heavily in boilers. They formed lime salts of all kinds, but on the eastern end of the road they had freestone water, juniper water, etc.

Mr. Wade gave his experience by saying that in 1885 he put in service four consolidation engines, with radial staybolts, in 1886 16 more, making 20. All of those engines had been in service since and never had a firebox of which he was aware, been thrown aside. Two or three of them had been worked on, on account of defective sheets. His water was freestone water. The fireboxes were working with considerable life in them. No fireboxes nor sheets, except the two mentioned, had been renewed.

Mr. Sanderson looked upon that as in line with the explanation offered that, where the sheets were clean, experience showed a difference of 28 deg. in the temperature. Were the thickness less than seven-sixteenths, the temperature variation would be still less. He believed he was right in saying that that which is best under the worst condition of things is best under the best conditions.

Mr. Anderson reported a great deal of trouble with hollow staybolts. He had found that some of them would leak. They were not broken, but split in the hollow. He had had a great deal of trouble with one class of engine—the shallow firebox, and had discontinued putting in hollow staybolts and now uses the solid altogether. He has had a good many solid bolts broken also.

Mr. Sanderson suggested as a cause of failure, the slight difference in number of threads per inch between the tap and die used which cannot be detected easily. When this was the case the sheets will be forced out of place gradually, throwing great strains on some of the stays.

Mr. Wade believed that the committee was correct in their conclusion, and thought it would be safe to work on that line. That the only question to determine between the hollow and solid staybolt was the question of quality.

Mr. Hooker expressed the belief that the turned down rolled hollow staybolt was the thing wanted. He thought that the hollow rolled staybolts, turned down in the centre, were better than the drilled bolt.

The committee reported that other roads had reported that they had found no especial advantage in turning down stays, but an explanation of this was because they barely turned off the thread and did not reduce the diameter sufficiently.

Mr. Sanderson recommended the use of United States standard thread for staybolts, instead of the sharp "V" thread.

Mr. Hooker suggested that there might be a difference of 100 per cent. between these tests made by the committee and others made under temperature of 150 or 250 deg.

This ended the discussion, but not the *work*. A code of rules for "Staybolt Practice" has been formulated by the Chairman of the Committee, Mr. R. P. C. Sanderson, which is based upon the tests, inquiries and investigation made by its members and the discussions of the Club, supplemented by some subsequent individual work. These rules have been drawn up and are offered to railroad men for their consideration and criticism.

PROPOSED RULES FOR STAYBOLT PRACTICE.

1. Rules for Testing Locomotive Boilers—Shop Tests.—Boilers of all new locomotives must be subjected to

a hydraulic pressure of 25 lbs. per square inch above their rated pressure before going into service. The same test must be made to the boilers of all locomotives going through the shops for general repairs, numbers 2, 3 and 4, and on special occasions if there are indications that there is any weakness about any portion of the boiler. When boilers are being tested, the foreman or master mechanic of the shop where the test is being made must attend personally, remaining outside while an assistant examines the firebox carefully from the inside. A report of all tests must be made, giving dates and remarks about anything that is worthy of mention, which must be signed by the foreman or master mechanic and person assisting, and forwarded to the Superintendent Motive Power. The boiler must be heated to nearly the boiling point of water before the test is commenced. This preferably to be done by filling the boiler with hot water.

2. Roundhouse Test of Staybolts:

Careful examination of stabolts of locomotive boilers in service must be made each time the boiler is washed, and at any intermediate time when the staybolts show signs of leaking. But in no case should this examination be less frequent than once every 30 days. After the boiler has been washed and cooled off, all plug holes and openings must be closed, and from 40 to 50 lbs. of air or steam pressure introduced into the boiler without water; a trained boilermaker must then enter the firebox and tap each staybolt from the firebox side by striking the heads light, sharp blows with a medium weight hand hammer, judging by the sound whether the staybolts are broken or not. All broken or doubtful stays must be removed and replaced before the engine returns to service. No locomotive shall be allowed to remain in service while there are one or more broken staybolts in the top or end rows. After the examination by sounding is completed, a careful inspection of all hollow staybolts must be made, and if the holes in the said staybolts appear to be closed up, either at the outer end or inside, they must be opened by running in a wire or breast drill.

3. A weekly report of the broken staybolts must be sent to the Superintendent Motive Power, showing the location of all broken staybolts, using the following form:

.....189..

Mr.....

Supt. M. P.:

Dear Sir:

Below I beg to hand you a report of staybolt inspection for the week ending.....189....

Date.	Engine No.	Condition.	Location.
7-1—93	258	O. K.	
7-1—93	317	6 broken	{Right—O, 1 to 3; Left—N, 1 & 2; O, 1.

Note.—Horizontal rows indicated by letters A, B, C, etc., commencing at mud ring. Vertical rows indicated by figs. 1, 2, 3, etc., commencing at front or right side.

4. At any time when the dome cap and throttle have to be removed, or when the flues are removed in the locomotive boilers, so that an internal inspection of the braces can be made, all rods, stays, braces, etc., must be carefully examined to see that they are taut, free from cracks and not sufficiently rusted or corroded to materially weaken them. The sheets of the boiler must also be examined as far as they can be got at, for pitting, corrosion and grooving, especially in the neighborhood of existing leaks.

The following rules are also recommended as good staybolt practice:

1. That hollow staybolt iron be bought under specifications requiring from 48,000 to 50,000 lbs. ultimate tensile strength, with an elongation of 45 per cent. on 2 in. and a reduction of area of 55 per cent. Bars to be of uniform roundness, to show a fine long fibrous fracture and to be free from longitudinal seams and defects.

2. That such hollow stays be used in portions of the firebox where stays are most likely to break, which are in the top and second horizontal rows of the side sheets in the Belpaire or crownbar boilers, and in the horizontal rows, at the reverse bend or O. G. in radial stayed or crownbar boilers. That hollow staybolt iron be used for the top staybolts of the first and second vertical rows in the front and back of the side sheets in all boilers. That hollow staybolt iron be used for the upper right and left-hand corner stays in the back sheets and front sheets of all locomotives.

3. That the hollow staybolt iron have a 3-16-in. hole through it.

4. That the hollow stays be not opened up on the inside of the firebox after the heads have been formed, but that the outside holes be opened and kept open for a distance of not less than 4 in. from the outer sheets. This to be done by the use of cleaning wires or breast drills each time the stays are examined.

5. That the jackets of all locomotives be so arranged with thimbles or ferrules at the location of these hollow staybolts that the ends of these stays can be seen plainly without having to remove any portion of the jacket or lagging.

6. That all such staybolts in the first four horizontal rows of the side sheets and the first two horizontal rows of the back sheets should be turned down in diameter between the sheets a scant ¾ in., and that this diameter of the centre portion be maintained in renewals, no matter to what sizes the threaded portions have to be enlarged to enable a good thread to be obtained in the sheets.

7. That the United States standard section of thread of 12 threads per inch be considered as the standard section of thread for all staybolt taps and dies.

8. That in putting in staybolts, where large numbers of them have to be applied, such as when putting in new fireboxes, the tapping of holes shall be closely followed by the putting in of the staybolts, so that there will be no chance of the sheets becoming drawn and the threads mis-matching, as is the case where large numbers of holes are tapped first and the stays put in afterward.

9. That care be taken to see that staybolt taps be kept cool and not allowed to expand by becoming hot when used with flexible shaft or air drill.

10. That the foreman or master mechanic be required to periodically examine his staybolt taps and the stays which are threaded by dies or chasers to see if the threads do absolutely match. This test must be made on samples of not less than 18 in. in length.

11. Further, that the stays which hold the front sheets and back sheets of all long fireboxes, which are located below the brick arch on the outside of fireboxes should be removed if they are set too close to the side sheets, so as to allow greater freedom for the inside firebox to expand without crushing the lower portions of the side sheets, as is the case at present. If, then, the unsupported space of the outside firebox be too great with this arrangement, the present second row of stays can be moved out (one-half way) from their present position toward the present position of the first row, so as to assist in supporting the sheet.

12. In designing new fireboxes, the corners of the mud rings and boilers should be arranged with longer sweeps, to allow of greater flexibility at these corners, and to help support themselves without the assistance of stays.

13. That the front and back sheets of all fireboxes above the crown sheets should, on new boilers, be so stayed that expansion can take place in the firebox sheets and flues, while the outer sheets are cold, without causing too severe strains on any portion of the boiler, and that in the throat sheet braces, as well as the upper braces of our present boilers, the pin holes should be so made that the braces will be all taut when the boilers are cold, but in case the inside firebox becomes longer, the slack in the pinholes will allow of longitudinal movement until such time as the outer sheets of the boiler become heated up to a corresponding length, when the brace will then again give the full support required. The long through braces running from the front flue sheet to the back boiler head are unquestionably objectionable, and their use should be abandoned. The portion of the back heads and front flue sheets needing support should be carried as much as possible by girder braces from the side sheets, rather than by longitudinal through stay rods.

Chicago News.

Freight Traffic.—The receipts here by ten lines traversing the grain section for last week were 4,337,000 bushels, an increase of 1,075,000 bushels over the same week last year. There was a small gain in live stock but outward shipments were small. It is useless to hope for an improvement in this until the clouds in the financial sky disappear.

The following exhibits the receipts of flour and grain at Chicago by eleven Western railroads during the month of July, and the amount delivered by each road:

By	1893.		1892.	
	Flour.	Grain.	Flour.	Grain.
	Bbls.	Bush.	Bbls.	Bush.
C. & N. W.	41,151	3,346,000	55,184	2,537,000
Ill. Cent.	4,500	2,930,000	175	1,315,000
C., R. I. & P.	35,400	1,574,000	23,850	2,405,000
C., B. & Q.	40,189	4,438,000	37,415	3,221,000
C. & Alton	4,277	624,000	37,440	802,000
C. & E. Ill.	.....	429,000	.....	532,000
C., M. & St. P.	72,510	1,706,000	75,400	2,040,000
Wabash	2,557	808,600	7,605	756,000
C. & G. W.	47,361	623,000	92,477	1,099,000
A., T. & S. Fe	15,091	613,000	1,925	1,512,000
Wis. Cent.	784	5,000	2,260	6,000
Totals	267,819	17,096,000	332,731	16,228,000

The receipts of the above articles from Jan. 1 to July 31, inclusive, by the same lines, the current and preceding year were:

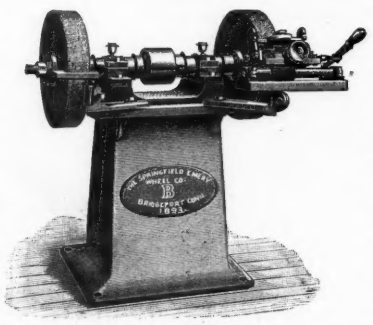
By	1893.		1892.	
	Flour.	Grain.	Flour.	Grain.
	Bbls.	Bush.	Bbls.	Bush.
C. & N. W.	721,868	18,003,000	768,055	13,397,000
Ill. Cent.	34,120	15,314,000	14,755	11,319,000
C., R. I. & P.	136,975	15,988,000	127,850	14,138,000
C., B. & Q.	455,736	32,338,000	414,115	20,791,000
C. & A.	45,922	3,234,000	119,417	3,674,000
C. & E. Ill.	7,150	2,483,000	750	2,412,000
C. M. & St. P.	765,205	13,914,000	755,025	16,540,000
Wabash	28,620	3,234,000	45,161	3,371,000
C. & G. West.	382,224	5,119,000	588,125	5,031,000
A., T. & S. Fe	37,604	6,821,000	5,781	7,048,000
Wis. Cent.	33,975	110,000	366,523	571,000
Totals	2,649,397	116,578,000	3,205,557	98,292,000

Passenger Traffic.—The volume of passenger traffic the past week was slightly below that of the preceding week. The figures returned by the exposition officials showed only 530,177 paid admissions, against 596,326 the preceding week. The railroad officers who have opposed lower rates now feel sure that the people who were ready, or could afford to come, were already doing so in liberal numbers, and that a reduction in rates simply means a loss of revenue. General Manager Merrill, of the Burlington, thinks the result of last week's traffic fully demonstrates that his views were correct. An official of one of the lines that advocated low rates, on the theory that business would more than double, admitted that he was greatly disappointed. An official of the Rock Island sent an assistant over every portion of the line to consult the people's wishes as to cheap fares. A very large majority said that they were either not ready to visit the Fair, or unable to afford the other expenses of the trip, and therefore could not come even if free transportation were granted.

Retrenchment in expenses continues. The Managers' Association has held frequent meetings to devise means by which additional reforms can be made and some trains may be taken off.

Dynamo Brush Grinder.

The engraving shows a new brush grinder, with universal slide rest, just brought out by the Springfield Emery Wheel Co., of Bridgeport, Conn. The machine weighs 500 lbs., stands 37 in. from the floor to the centre of the spindle and occupies a space of 20 in. × 24 in. The length of the bearings is 5¼ in., diameter of spindle in bearings 1¼ in. and between flanges 1 in. The distance between wheels is 21 in. and the entire length of the spindle 32 in. Any size of emery wheel can be used up to 16 in. The rest is arranged to grind dynamo brushes, and the clamp can be adjusted for any size of brush. The work is fed up to the wheel by a screw with milled head, in the back of the rest, and is passed over the face of the wheel by means of the hand lever at the right of the rest. The brush can be adjusted to any angle or bevel required.



Train Accidents in the United States in June.

COLLISIONS.

REAR.

4th, on Pittsburgh, Fort Wayne & Chicago, at Van Wert, O., an express train which stopped at an unusual place to take on a dining car was run into at the rear by a freight train, badly damaging the rear passenger car and several freight cars. The freight train had just started out of a side track, having waited at Van Wert for the passenger train to pass it.

5th, 1 a. m., on New York & New England, at Pomfret, Conn., a freight train which had stopped near the foot of a grade was run into at the rear by a following freight, wrecking the engine and several cars, all of which fell down a high bank. A brakeman was killed.

10th, on Union Pacific, at Gothenburg, Neb., a freight train standing at the station was run into at the rear by a following train, making a bad wreck. One tramp was killed and another fatally injured. There was a dense fog at the time.

14th, 4 a. m., on New York, Chicago & St. Louis, at Hamburg, N. Y., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, making a bad wreck. A tramp was killed and 1 tramp and 3 trainmen were injured.

14th, on Chicago & Northwestern, near Belle Plain, Ia., passenger train No. 4 ran into a coal car standing on the main track, wrecking the coal car and the engine and damaging the first two cars of the passenger train. The fireman was killed and the engineer was injured.

16th, on Chicago, Milwaukee & St. Paul, near Summit, S. D., a freight train broke in two behind the third car from the engine and the rear portion immediately afterward ran violently into the cars ahead, these having been stopped by the automatic application of the air brake. The wreck was a bad one, and a brakeman was killed.

20th, on Manhattan Elevated, Ninth Avenue line, at 13th street, New York City, a passenger train which had been stopped just beyond a curve in consequence of a slight delay in repairing the track was run into at the rear by a following passenger train, the platforms of several cars being crushed. Seven passengers were slightly injured.

20th, on Baltimore & Ohio Southwestern, near Loveland, O., a passenger train which had been stopped on account of a freight train being stalled ahead of it was run into at the rear by a following passenger train. It is said that the second passenger train was properly signaled, but that the rails were wet and the train running very fast.

21st, on Pittsburgh & Western, at Lowellville, O., a freight train which had stopped on account of a hot box was run into at the rear by a following freight, making a bad wreck. An engineer was injured. It is said that the flagman of the standing train did not go back.

21st, 3 a. m., on Columbus, Hocking Valley & Toledo, near Prospect, O., northbound freight train No. 63 broke apart in two places and a collision followed, wrecking 14 cars. Six tramps riding on the train were injured, one of them fatally.

22d, 3 a. m., on New York, New Haven & Hartford, near Berlin, Conn., a freight train descending a grade broke in two and the forward portion, the speed of which was accelerated, ran into the rear of a preceding freight train, wrecking 4 cars. A brakeman was injured.

23d, midnight, on New York Central & Hudson River

at Corfu, N.Y., a freight train drawn by two engines ran into the rear of a preceding freight, badly damaging 2 engines and 25 cars. Seven trainmen were injured. A brakeman was also injured by falling from a car of a train following closely behind the second train, which was stopped very suddenly. There was a dense fog at the time of the collision.

27th, on New York, Lake Erie & Western, at Castile, N. Y., the forward engine of a double-header freight was detached some distance west of the station, and run forward to take water. While it was standing at the tank a coupling failed in the train, which was running on a descending grade, and the second engine, with about 15 cars, was run forward so fast as to collide with the forward engine. Thirteen loaded cars were badly wrecked and a brakeman was injured.

30th, on Fitchburg road, at Williamstown, Mass., a freight train descending a grade broke in two and the rear portion ran into the forward one, injuring a brakeman.

And 17 others on 13 roads, involving 1 passenger train and 28 freight and other trains.

BUTTING.

1st, on Missouri, Kansas & Texas, at Little River, Tex., butting collision of freight trains, one of the trains having run about 1,200 ft. beyond the meeting point "because the airbrakes did not work." On one of the trains were some passengers, who were getting out of the cars when the collision occurred, this train having nearly stopped. Several passengers were injured, and an engineer and a fireman were badly hurt.

1st, on Chicago & Northwestern, near Montour, Ia., butting collision of freight trains, doing considerable damage; one engineer was injured. It is said that a meeting order intended for both trains was delivered only to one.

4th, on St. Louis, Iron Mountain & Southern, near Poplar Bluff, Mo., butting collision of freight trains on a trestle, wrecking both engines and 17 loaded cars. About 100 head of cattle were killed. The trainmen escaped with slight injuries.

5th, 11 p. m., on Delaware, Lackawanna & Western, near Cortland, N. Y., butting collision between a passenger train and an empty engine on a bridge, wrecking both engines. The passenger engineer was killed and the fireman fatally injured. The empty engine had no person upon it, having started unaccountably from a side track at Cortland station. The night watchman who was charged with the custody of this engine was arrested on a charge of manslaughter.

13th, 6 a. m., on St. Louis & San Francisco, near Butler, I. T., butting collision between a southbound passenger and a northbound stock train, both running at considerable speed. Both engines, 1 baggage car and 6 cars of stock were wrecked and 100 cattle killed. One engineer and 1 fireman were killed and 5 other trainmen and 2 passengers were injured. It is said that the train dispatcher gave conflicting orders.

14th, 9 p. m., on New York, Lake Erie & Western, at Hoboken, N. J., butting collision of freight trains, badly damaging both engines and several cars. One fireman was injured.

17th, on Chicago & Grand Trunk, near Duffield, Mich., butting collision between freight trains 51 and 32, wrecking both engines and 20 cars. One engineer and 1 fireman were injured. There was a dense fog at the time.

17th, 4 a. m., on Baltimore & Ohio, near Cameron, W. Va., butting collision between freight trains 89 and 92, both running at considerable speed. Both engines and 20 cars were wrecked, and 2 trainmen were killed and 3 injured. It is said that one of the trains ran past a signal which had been displayed at Floyd's to stop it.

21st, on Chicago, Burlington & Quiney, near Buda, Ill., butting collision of freight trains; 4 trainmen injured. It is said that there was a mistake in telegraphic orders.

22d, on Philadelphia, Reading & New England, at Canaan, Conn., butting collision of freight trains, badly damaging both engines and several cars. A tramp was injured.

22d, on New York & New England, near Bristol, Conn., butting collision between a passenger train and a freight, badly damaging both trains and injuring the baggagemaster. The freight met another first class train at the point where the passenger train should have been met, and the engineer then went on, forgetting about the passenger train.

24th, on Lehigh Valley, near Harvey Lake, Pa., butting collision between an inspection train and a freight train, the latter having gone beyond an appointed meeting place. A brakeman was badly injured.

And 6 others on 6 roads, involving 2 passenger and 10 freight and other trains.

CROSSING AND MISCELLANEOUS.

5th, at the crossing of the Houston & Texas Central and the Missouri, Kansas & Texas, at Denison, Tex., a switching freight train of the former road became uncontrollable, owing to a defective brake, and ran into a freight of the latter road, and both engines were overturned. Several cars were wrecked and 1 employé was injured.

6th, on Monongahela Connecting road, at Pittsburgh, Pa., a freight train ran into a small yard engine belonging to a mill. A brakeman riding on the front of the freight engine was killed and the runner of the yard engine was injured.

7th, on New York, New Haven & Hartford, at West Lyme, Conn., a passenger train ran into a freight engine which was switching on the main track, doing slight damage. Both engineers and both firemen were injured.

9th, on Baltimore & Ohio, at Riverton, Pa., collision between a freight train and a switching train. A tramp was killed and another injured.

12th, on Colorado Midland, near Colorado Springs, Colo., a freight train was run into at the rear by two cars of stone which ran out of a side track on a steep grade. One employé was injured.

16th, on Western & Atlantic, near Bartow, Ga., collision between a passenger train and a freight train. One trainman was killed and several injured.

17th, near Winfield, Kan., a freight train of the Atchison, Topeka & Santa Fe ran into the rear car of a Missouri Pacific passenger train at the crossing of the two roads, overturning 2 cars and injuring 3 passengers and 1 trainman.

18th, on New York, New Haven & Hartford, at South Norwalk, Conn., a mixed train ran over a misplaced switch and into an engine standing on the side track, badly damaging both engines. A brakeman and a fireman were injured.

19th, on Baltimore & Ohio, near Wheeling, W. Va., a switching engine, which was to be coupled to some moving freight cars, ran against them so violently as to derail several cars, which fell over and badly injured 2 boys.

19th, 3 p. m., on Missouri, Kansas & Texas, at Caddo, I. T., the southbound "Chicago flyer," pulling into the side track, was struck in the side by the north bound Chicago flyer, which approached at uncontrollable speed. The chair car was overturned, and the sleeping car badly damaged. Two trainmen were injured.

19th, at Junction City, Ky., passenger train No. 1 of the Cincinnati, New Orleans & Texas Pacific ran into a freight of the Louisville & Nashville at the crossing of the two roads. The passenger engine and two freight cars were overturned. One trainman was injured.

20th, on Bennington & Rutland, at North Bennington, Vt., a passenger train ran into a freight standing on the main track. The express messenger and three passengers were injured.

25th, on Philadelphia & Reading, at Philadelphia, a freight train crossing from one track to the other was run into by another freight, approaching at low speed, and 1 engine and 8 cars were overturned. The engineer of the approaching freight was killed. It appears that he disregarded a fixed signal which warned him to approach under control.

28th, at Virginia Point, Tex., a passenger train of the International & Great Northern ran over a misplaced switch and into a passenger train of the North Galveston, Houston & Kansas City road, at the junction of the two roads. A brakeman on the latter road was killed and 2 passengers were injured.

And 9 others on 7 roads, involving 1 passenger train and 17 freight and other trains.

DERAILMENTS.

DEFECTS OF ROAD.

4th, 1 a. m., on St. Louis, Iron Mountain & Southern at Leeper, Mo., passenger train No. 755 was derailed at a defective switch, most of the cars being upset. The reclining chair car was badly wrecked. Seventeen passengers and 1 trainman were injured.

5th, on Kansas City, Fort Scott & Memphis, at Memphis, Tenn, a yard engine was derailed by spreading of rails and ran into the ditch. Two brakemen riding on the front end were crushed to death.

6th, on St. Louis & Southwestern, near Athens, Tex., a mixed train was derailed at a bridge and most of the cars fell into the creek. Three passengers, 1 brakeman and 1 section master working near the bridge were injured. It is said that a heavy loaded car crushed the bridge by its weight.

11th, on Ohio Southern, near Harris, O., passenger train No. 3 was derailed on an 18-degree curve at a point where the track had buckled in consequence of the expansion of the rails by the extreme heat of the sun, and the tender, baggage car and 2 passenger cars were ditched. Several passengers were injured, one somewhat seriously.

14th, on Atlantic & Pacific, near Holbrook, Ariz., an eastbound passenger train was derailed by a broken rail. A tramp riding on a truck was killed and another tramp and 2 trainmen injured.

16th, on Northern Pacific, at West Superior, Wis., a freight train was derailed at a defective switch and the engine and 4 cars ditched. The engineer was injured.

16th, on Missouri Pacific, near Jefferson City, Mo., 2 cars of a passenger train were derailed and overturned by a broken rail. Three passengers and 3 trainmen was injured.

22d, 4 p. m., on Georgia Pacific, near Cardiff, Ala., a freight train ran upon a burning trestle and the entire train, consisting of an engine and 13 cars, fell about 40 ft. into the ravine below, and, with the trestle, was burned up. The trainmen all jumped off before the train fell. The trestle was 250 ft. long.

24th, on New York, Ontario & Western, near East Branch, N. Y., passenger train No. 1 was derailed while running at high speed by spreading of rails. Four cars were ditched and two of them badly damaged.

25th, on Great Northern, at Minneapolis, Minn., a yard engine was derailed at a defective switch and 2 employés were injured.

And 6 others on 6 roads, involving 1 passenger train and 5 freight and other trains.

DEFECTS OF EQUIPMENT.

2d, on New York, Lake Erie & Western, near Narrowsburg, N. Y., a freight train was derailed by the breaking of a journal, and the tender and 20 cars fell down a high bank. The fireman was injured.

2d, on Norfolk & Western, near Petersburg, Va., the engine of a freight train was wrecked by the explosion of its boiler, and 20 cars were derailed and badly damaged. The fireman was badly scaled.

8th, on Philadelphia & Reading, at Sheridan, Pa., a freight train running at considerable speed was derailed by a broken wheel, 27 cars being wrecked. Just before the accident occurred five tramps had been ordered out from between the wrecked cars and placed under arrest.

23d, on Philadelphia & Erie, near Warren, Pa., a freight train was derailed by a broken wheel and 12 cars were ditched. Two tramps were killed and 2 injured.

28th, on Pennsylvania road, near Fairbanks, Pa., a freight train descending a steep grade was derailed while running at high speed, by a broken axle. Twenty cars were wrecked. A brakeman was killed and a trackman fatally injured.

And 10 others on 7 roads, involving 1 passenger train and 9 freight and other trains.

NEGLIGENCE IN OPERATING.

5th, on Baltimore & Ohio, at Clarksburg, W. Va., a passenger train of the Monongahela River road was derailed at a misplaced switch, badly damaging the engine and several cars. The engineer was injured, probably fatally.

7th, on Toledo & Ohio Central, near Johnson, O., a freight train was derailed by a large stone which fell from one of the cars, and 8 cars were wrecked. One brakeman was killed and 4 trainmen and 2 passengers injured.

12th, on Rio Grande Western, near Green River, Utah, a passenger train was derailed at a switch, the engine being partially overturned. There was a furious sandstorm at the time, and it is said that the switch had probably been imperfectly fastened by reason of the sand lodging between the switch rail and main rail.

20th, 5 p. m., on Long Island road, near Parkville, N. Y., a heavily loaded passenger train was derailed at a derailing switch and 4 cars were partially overturned. Two of the cars fell against the side of a cutting and two ran along until they came to the Parkville tunnel, where a number of passengers were injured by being crushed against the lining of the tunnel. The derailed cars were open at the sides, with longitudinal steps, made after the English fashion, and a number of passengers were standing on these steps, the train being crowded with men returning from the horseraces at Coney Island. Seven passengers were killed and over 20 injured. It is said that all of the killed were standing on the steps when the cars tipped over. The speed of the train is variously estimated at from 10 to 40 miles an hour. The signalman, who was some distance from the switch, is accused of turning it under the train, and the State Railroad Commissioners conclude that the evidence on this point convicts him, though most or all of it was indirect. There was no detector bar on the switch.

And 8 others on 8 roads, involving 2 passenger and 6 freight and other trains.

UNFORESEEN OBSTRUCTIONS.

1st, on Richmond & Danville, near Ridgeway, S. C., a mixed train was derailed by running into a washout, and the engineer and fireman were killed. Several cars fell down a bank.

6th, on Fort Worth & Denver City, near Decatur, Tex., a freight train was derailed by running over a cow, most of the cars being ditched. The fireman was injured.

7th, 3 a. m., on Chicago & Alton, at Vandalia, Mo., the engine and 3 cars of a passenger train were derailed by running over a cow. The express messenger was injured.

8th, on New York, Lake Erie & Western, at Jamestown, N. Y., westbound passenger train No. 3 was derailed by stones which had lodged in the flangeway at a highway crossing, and the engine and first 3 cars fell down a bank. The mail car was badly wrecked. The fireman was scalded, and 2 mail agents slightly injured.

14th, on Kansas City, Memyhis & Birmingham, near Carbon Hill, Ala., an engine and caboose running at considerable speed were wrecked by an obstruction which had been maliciously placed upon the track, the engine being overturned. The engineer was killedand 3 other trainmen were injured.

21st, on Great Northern, near Kalispel, Mont., a freight train was derailed at a washout and the engine and most of the cars fell down a high bank into the Kootenai River. Several trainmen were injured.

24th, on Great Northern, near Partridge, Minn., a freight train ran over a steer on bridge No. 103 and the engine and 18 cars were piled up in a bad wreck. The engineer and 1 brakeman were killed and the conductor and fireman injured, the latter fatally. The wreck took fire and was mostly burned up.

27th, on Union Pacific, near Clarnie, Or., passenger train No. 1 was derailed by running over a cow, and the engine and 3 baggage cars fell down a bank. A tramp was killed.

28th, on Wilmington & Northern, at Wawaset, Pa., a freight train was derailed by running over 2 cows, and several cars fell down a bank into the Brandywine River. A brakeman was badly injured.

28th, on Ohio River road, near Point Pleasant, W. Va., a freight train was derailed at a washout, and 9 cars were overturned. A brakeman was injured.

And 7 others on 7 roads, involving 2 passenger and 5 freight and other trains.

UNEXPLAINED.

2d, on Nashville, Chattanooga & St. Louis, near Newsom, Tenn., the rear car of a passenger train was derailed and fell down a high bank. Eleven passengers were injured.

13th, on Pennsylvania road, near Harrisburgh, Pa., a freight train was derailed, making a bad wreck. Three trainmen were injured.

15th, on Rome, Watertown & Ogdensburgh, near Philadelphia, N. Y., a work train was derailed and the fireman injured.

19th, 3 a. m., on Norfolk & Western, near Kent's, Va., a freight train was derailed and the engineer injured.

20th, on Lehigh Valley, near Athens, Pa., a freight train was derailed and 1 employé killed.

22nd, on Illinois Central, near Greenfield, Tenn., several cars in a freight train were derailed and a brakeman was injured.

23d, on Baltimore & Ohio, near Connellsville, Pa., freight train was derailed and a tramp was killed. Three trainmen were injured.

24th, on Cincinnati, Georgetown & Portsmouth, near Cedar Point, O., a work train was derailed and the engine was overturned. The conductor, engineer and fireman were injured, one of them fatally.

27th, on Illinois Central, at Eighty first street, Chicago, a passenger train of the Cleveland, Cincinnati, Chicago & St. Louis was derailed, the engine and baggage car being ditched, engineer, fireman, and 2 passengers were injured.

And 27 others on 21 roads, involving 7 passenger and and 20 freight and other trains.

OTHER ACCIDENTS.

Under this head there were 5 accidents on 5 roads, involving 3 passenger and 2 freight trains.

A summary will be found on another page.

Foreign Railroad Notes.

The Southern Railroad of France reports that the reduction of passenger rates which went into effect April 1, 1892, resulted in an increase of 14 per cent. in passenger traffic and a decrease of 6 per cent. in passenger earnings. Of the whole number of journeys no less than 48 per cent. were made on go-and-return tickets. There was an important decrease also in the express freight earnings, the rates having been greatly reduced. A decrease in freight earnings was due to the new French customs tariff, which has reduced the interchange of freight between France and Spain.

The Paris, Lyons & Mediterranean reports for the same period an increase of 16 per cent. in the passenger traffic and an insignificant increase in passenger earnings. The express traffic increased one-sixth, and the earnings from it 7.7 per cent. Both these companies report a considerable increase in working expenses, attributed to the larger passenger traffic, and both require larger contributions from the state to pay the guaranteed dividends.

The Eastern Railroad, which extends to the German and Swiss border, had an increase of nearly 10 per cent. in passenger earnings, not enough to balance the decrease in freight earnings. A decrease in export freights from 27,826 to 25,143 kilometric tons, and in the import freights from 99,000 to 70,688 tons, is attributed to the new protective tariff. The company requires from the state on account of its guaranty 4,915,218 francs more than in 1891.

The entire system of railroads of "general interest" in France earned very nearly the same in 1892 as in 1891,

the length worked having increased from 21,509 to 21,950 miles, and the total earnings from $225,388,017 to $226,046,535, while the earnings per mile decreased from $10,479 to $10,298—a sufficiently favorable result, in view of the important reduction in passenger and express rates.

The French railroads require a ticket for all dogs carried, even for lap dogs taken into the passenger cars. A passenger took a new-born puppy in a hand basket into the car with him without getting a dog ticket. The existence of the beast was discovered, and the passenger was brought up before the police court at St. Lô, charged with cheating the railroad company. This court let him off, on the ground that the provision requiring a ticket for dogs meant dogs that could bite, while a new-born puppy might be taken under the provision that admits "small animals in cages or baskets" as baggage. But on appeal the court at Caen reversed this decision and flued the passenger one franc, declaring it an error to distinguish between a puppy and a grown dog that can bite, the distinction being arbitrary and difficult to apply.

In southeastern France of late years quite a system of narrow-gauge railroads has been built a little back from the coast, on or near which the old railroad from Marseilles to Italy lies. The new lines were considered important for strategical purposes, but they are largely in a very hilly district, with no considerable towns, and have required some heavy work. One of these lines extends from Nice westward. Last year its gross earnings were 740,027 francs, and its working expenses 1,068,537 francs, or 144 per cent. of the earnings. Another line owned by the same company, a little farther west, from St. Raphael to Hyères, earned 238,841 francs at a cost of 328,510, and a system of steam tramways owned by the same corporation had 57 per cent. more expenses than earnings.

There is a general association of railroad employees in France which held a meeting not long ago and expressed its desires as follows: That the state should acquire and work all the railroads; that all engineer soldiers be withdrawn from the railroad service where they are kept to be trained for the necessities of war; that the railroad officers should be chosen by universal suffrage [of the employees, presumably]; that the minimum rate of pay be 1,200 francs and the maximum 4,000 francs per year; that every employee be entitled to a retiring pension after 20 years' service, and that the minimum retiring pension be 1,200 francs a year; that the working day be eight hours, and that in addition every employee be entitled to 72 hours off in every fortnight and 15 days' vacation every year.

The French railroad men seem to be in favor of taking it easy.

The Paris, Lyons & Mediterranean company, after experimenting with electric car-lighting apparatus for three years, has decided to equip 50 first-class cars with electric lights fed by storage batteries. There are two lights, each of 10 candle power, in each compartment, but only one burns at a time. As soon as one is extinguished the other is lighted automatically. The batteries suffice for 35 hours' lighting. Oil lamps are provided for use in case of need.

The Belgian State Railroads have recently issued tickets at $6, $4.50 and $3 each for the three classes, good for traveling one week on all trains and in all directions throughout the state system. This is a little system, to be sure, on which no very long journeys are possible; but it reaches most places in the country, and one would suppose that an industrious drummer might get the full worth of his money out of one of these tickets.

There has been much discussion in Germany recently over the proper training, both in the service and before entering it, for the higher grades of railroad officers, a matter which, by the way, is made very difficult by the impossibility of knowing, till he has been tried for some time, whether any given person will ever be fit for one of these places. An officer of the Austrian State Railroads, Franz Girtler, has recently published a pamphlet on this subject, which, he thinks, would be solved best by the establishment of railroad academies with a three years' course, in which the chief subjects of study should be railroad operation, railroad law, administration, rates, the science of finance, national economy, merchandise, railroad history, geography and statistics, and also in a general way railroad engineering.

So long as such an institution does not exist, the man who aims to devote himself to the higher railroad service, Mr. Girtler says, should prepare himself by private study; and he proposes that every employee who is a candidate for a higher office be required to pass an examination which, besides showing a minute knowledge of his special branch of the service, shall prove such a general knowledge of the other branches as will qualify him to master their details, the main requirement being preparation for that special branch in which he serves himself. The author gives a detailed scheme of different branches in which he would have examinations. They include: Construction and maintenance of road service; train and shop service; traffic and telegraph service; transportation management and claims; the business of general administration, legal and taxation matters, land condemnation, rates, audit of receipts in connection with cashier's duties, stores, bookkeeping, accounts, treasury business.

With these special studies, he would include the more general ones of administration, railroad economics, general railroad law, and railroad history and geography. He indicates certain books, making quite a little library from which the studious employee could fortify himself for such examinations. In his special branch Mr. Girtler would require him to serve for three years before admitting him to examination for an office in it.

Erection of a Suspended Span of the Memphis Bridge.

Mr. George S. Morison, M. Am. Soc. C. E., Chief Engineer of the Memphis Bridge, has prepared for the Engineering Congress an admirable paper on the superstructure of that great work. The extracts which follow and the illustrations give details of the erection of one of the suspended spans, which have never before appeared in print.

They are from advance sheets of the *Transactions* of the American Society of Civil Engineers. There are two of these spans, each 451 ft. 8 in. long, and the one, the erection of which is described here, is part of the main span of 790 ft. 5 in. on the east end of the bridge, between Piers I. and II.

The actual erection of the last suspended span, the only portion of the Memphis Bridge which was erected without falsework, was begun on the 9th of February. A traveler of simple character, which consisted of a platform resting on the top chords and carrying two derricks guyed to a stiff frame, was set up at the east end of the west cantilever of this span (this being the cantilever which projects from the east end of the central span). The material was taken out in a barge under these derricks and lifted into position.

The weight of this suspended span was so great that the Chief Engineer hesitated about applying the adjustable wedges which have been used on similar structures at the connection between the cantilever arm and a suspended span. Oblong holes, each carrying two pins, were placed at the sliding joints (see plate XVIII.), and by placing adjustable wedges between these pins the position of the end of the projecting span could have been raised or lowered, or the span could have been moved backward. The Engineer, however, decided to erect the west end without any adjustment and the east end with a hydraulic adjustment, and to make the connection between the bottom chords with eye-bars, which, acting as a toggle joint, could take up variations of length. The Engineer now admits that this was an error in judgment. Wedges could have been used to better advantage than the fixed connections at the west end or the hydraulic connection at the east end. The hydraulic connection at the east end was used only in the bottom chord, a double wedge arrangement being used in the top; the double wedge is not as good as the single wedge.

After the cantilever arms had been built out, the opening between them, which had been triangulated, was measured direct with a steel wire. Computations were made showing the changes in length of the members of the central span, the anchorage span and the cantilever arms, resulting from the building out of the half spans of the intermediate span. The positions of the ends of the cantilever arms at the adjustment point under that condition were then calculated, as well as the form of the half span when built out. These calculations gave data for fixing the distance between the adjustment pins of the first half span (the west one) that was built. The distance between these pins, which determined the position of the free end of the half span when built out, was fixed by stationary castings (shown in Plate XVIII.); these were made in two parts, for convenience in handling. After the erection of the half span had been commenced, no change could be made in its final position.

When calculating the final position of the half span, it was assumed that the erecting outfit of traveler, engines, lines and scaffolds would remain on it until the span was swung. This was an error; the unusual weight of the span insured much difficulty in swinging, and it should have been assumed in the first place that all appliances not absolutely necessary in swinging the span would be removed as soon as the half spans were built out. They were removed, and the free end of the west half span, after their removal, was 5 in. above the elevation intended; this added materially to the subsequent difficulties.

The adjustment pins and castings for the west half span were placed Feb. 9 and 12. Erection was proceeded with and the half span erected to within one panel of the center of the span during the next 20 days. The traveler used for this purpose was then removed, and the erection engine, lines, etc., run back to the end of the cantilever arm.

The distance fixed between the adjustment pins had been based on calculations of extensions or contractions due to the increased strain resulting from the building out of the half spans; these computed changes in length were applied as corrections to the measured distance across the opening between the cantilever arms. The corrections to the upper chord opening depended on computed changes in length of chord members for a distance of 1,863 ft.; the corrections to the lower chord opening depended upon computed changes in length for a distance of 1,411 ft. A slight error in the assumption as to loading would produce an appreciable difference in the total extension or contraction in these distances; moreover, the members were in the main riveted members with heavy splice plates, tie plates and lattices, all of which increased the average cross-sections, so that with a correct strain sheet the calculated changes in length might be to a considerable extent inexact. It was, therefore, thought necessary to provide for a small adjustment for the east half span.

Wedges (shown in Plate XVIII.) were made for the upper chord adjustment. They provided for a total variation in distance between pin centers of only 1 in. Some small variations from plan dimensions reduced this range to about ⅞ in.

The removal of all appliances from the west half span not only caused the free end to rise above the elevation intended, but, by reducing the strains in all members, caused the free end of the upper chord to be about 1 in. west of the place expected. On the other hand, the time required for erecting the span was greater than had been expected, so that the connection at the center was made later in the season and at a higher temperature than had been assumed. These two changes in condition almost balanced each other.

It was expected that the wedges would be immovable after the half span had been built out its full length; they were to be used, however, for a final adjustment after the half span had been built out half its length. Before beginning the erection of the half span, the distance across the opening was again measured and the wedges placed at nearly mid-position, the measurement having checked previous measurements and computations within a small part of an inch. After the wedges had been placed and the erection of the half span commenced, the adjustment was not changed until the span had been released at the adjustment points at the west end.

When an attempt was made to move these wedges, the double wedge was found defective. One of the wedges would move first; the immediate result was a great increase of pressure on the other wedge applied at its small end; this fixed it in place, and as the screw was turned to continue the withdrawal, the movement of the first wedge continued until some means were used to prevent its movement.

For the lower chord adjustment at the east end of the span a hydraulic jack (Plate XVIII.) was provided for each truss. Each jack had a plunger 14 in. in diameter, with a stroke of 3¾ in. One force-pump was provided for operating these jacks; it was of special design and very simple in construction. The ordinary leather cup packing proved inadequate and was replaced by soft lead. The adjustment in the lower chord was simply the thrusting out of the hydraulic jacks to the proper distance to give the end of the half span, when built out, the same elevation as the end of the west half span, already built. The stroke of the jacks was not enough for this, but this was provided for by placing crescent-shaped fillers in the elongated pin-holes between one of the pins and the webs of the chord. When the half span was built half its length the jacks were used to increase the distance between the adjustment pins ¼ in. With this adjustment the limit of the capacity of the pump was reached, and as the erection proceeded this half span, like the west one, became unadjustable. When the half spans met at the center they were so nearly the same elevation that little difficulty was met in driving the center pins of the upper chords which closed the span and completed the connection between the upper chords and the web systems.

To supply the place of the end adjustments ordinarily provided for swinging the span, the Chief Engineer decided to depend mainly on expansion by temperature to extend the upper chord, and on a toggle joint to shorten the lower chord, so that the adjustment pins could be withdrawn. For one full-truss panel of the lower chord there were substituted two lengths of eye-bars connected to adjoining sections of bottom chord by temporary pins, and to each other by short coupling bars. A short vertical rod 2 in. square, having a nut at the lower end and an eye at the upper end, passed between each pair of coupling bars and through a washer which took bearing on the lower edge of the coupling bars. The toggle joint was completed by lifting on the 2-in. square rods. The eye-bars and couplings were planed to permit the insertion of the riveted lower chord sections after swinging the span, the top-flange angles being removed and riveted back again after placing. The arrangement of the bars is shown on Plate XIX. The eye-bars were called the toggle bars; the joint at centre was called the toggle joint, and the rods by which the toggle joint was pulled up were called the toggle rods.

As the ends of the half spans were too high, the opening in the lower chord between the ends of the riveted sections (one section at the centre being left out), when the joints in the upper chord were just brought into bearing, was nearly 4 in. less than the length of the closing section. It was necessary to raise the toggle joint 3 ft. before the toggle bars became taut. By loading the adjoining cantilever arms the lower chords were compressed so that the toggle bars became taut when the toggle joint was lifted 1¼ ft.

The erection of the east half-span ready for the closing sections was completed April 8; the traveler and all superfluous material were removed; a derrick was erected on the end of each arm to handle the closing sections. The season was well advanced, and for several days the temperature had been too high to close the upper chord sections, if all preparation had been made; but cooler weather came opportunely, and at 9 a. m. of April 10 they were inserted, with an opening of only ⅛ in. more than required.

During the next three days the inclined rods (Plate XIX.) for lifting the toggles were placed; in addition, two pairs of heavy triple blocks, rove with manilla line 2 in. in diameter, were placed in each truss, connecting the upper and lower chords at the centre of the span, each pair of blocks having a capacity of 25 tons. The derricks were taken down and all was in readiness to swing the span, but the weather became cold when heat was wanted.

During the swinging of the span changes in strain causing changes in length must occur. The total shortening thus caused in the upper chords amounted to about 4⅝ in. The distance between the fixed points on Piers I. and III. was 1,411 ft. 5½ in. The change in length for 1 deg. Fahr. was 0.0095 ft. To produce a change in length of 4⅝ in. required a change of 41 deg. The top chord at the centre of the intermediate span became closed at 56 deg. A temperature of 97 deg. was necessary to release the adjustment pins in the upper chord. This natural temperature could not be had, and various means were tried to swing the span at a lower one, all tending to increase the length of the upper chord.

During the several days of cool weather which followed the connection of the top chords at the centre of the span, the cantilever arms between Piers I. and II. were loaded with timber, rails, locomotives, etc., to about 6,000 lbs. per linear foot. The toggle rods were screwed up daily and the adjustment pins watched closely, but there was no sign of loosening. The resident engineer, Mr. Alfred Noble, adopted the expedient of heating the upper chord of the intermediate span with steam. A 1½ in. pipe was placed in each chord for the entire length of the span. Canvas was placed under the pipe on the lacing to retain the heated air in the chord; on the 19th of April steam from the locomotives was turned on the pipes, the toggle rods were screwed up, and as heavy a strain as they would stand was put on the lines, and blocks placed to assist in raising the toggle joint. As the temperature approached its maximum for the day it was found that Piers I. and III. were being pushed apart, the movement of Pier I. being ¼ in. and of Pier III. 1¼ in.; the possibility of this motion had been considered, both in its effect on the masonry of the piers and in

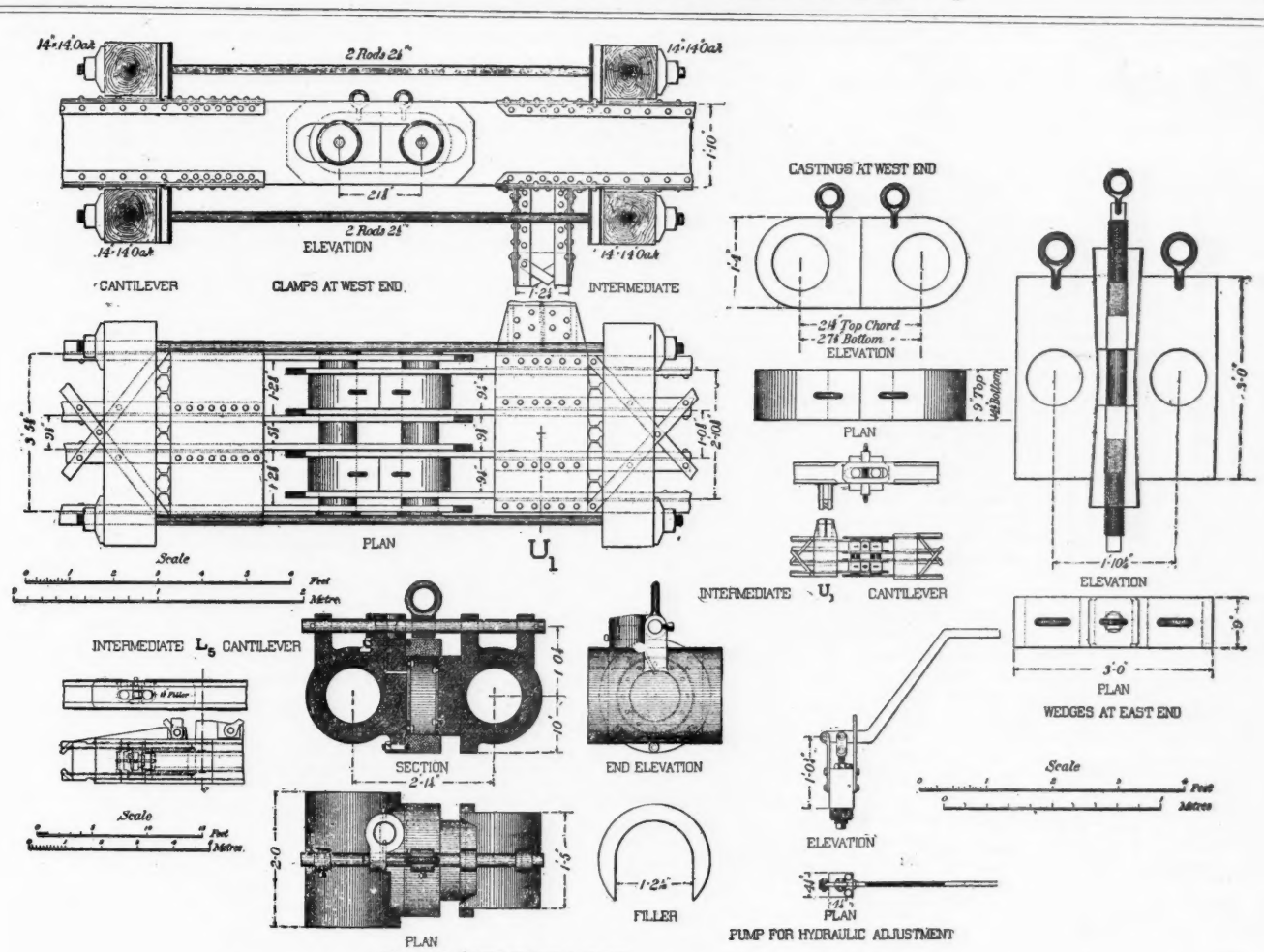


FIG. 18.—ERECTION OF MEMPHIS BRIDGE; ADJUSTMENT AT ENDS, INTERMEDIATE SPAN.

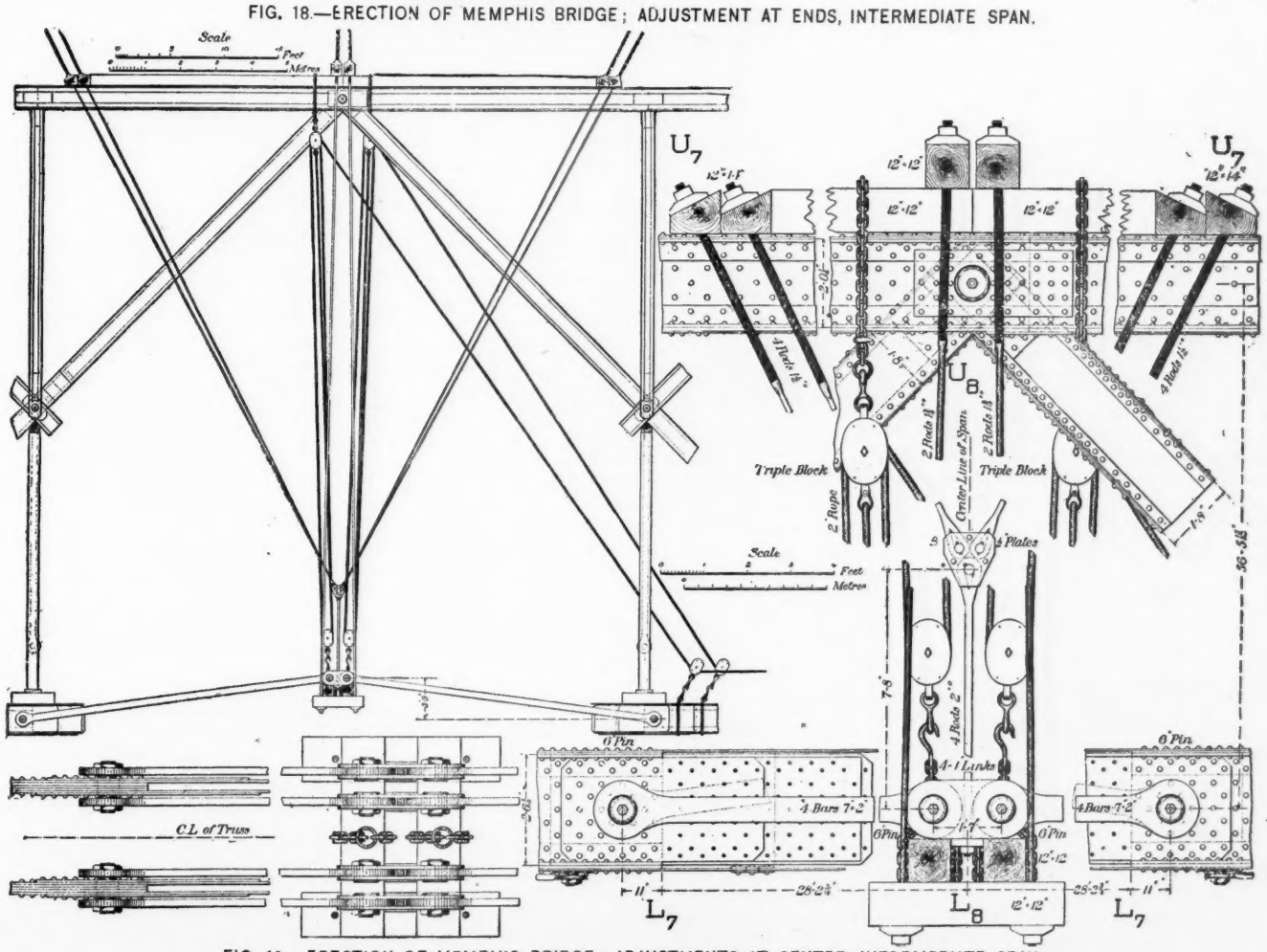


FIG. 19.—ERECTION OF MEMPHIS BRIDGE; ADJUSTMENTS AT CENTER, INTERMEDIATE SPAN.

swinging the span. Masonry, like all the other construction, is elastic; the piers could move much more than these amounts without injury. The motion of the piers, however, worked against the shortening of the top chord by compression, and this attempt to swing the span failed. It almost succeeded, however, as was shown by the fact that some of the upper chord web bearings could be moved on the pins.

During the next two days four rods, each 1¾ in. round, were placed in each truss, to connect the toggle joints with the centre of the upper chord and aid in lifting the toggles; steam pipes were laid in the upper chords of the central span extending half way from Pier II. to Pier III. Clamps (shown on Plate XIX.) were placed at the adjustment points in each of the upper chords at the west end of the intermediate span; each clamp consisted of four rods, 2⅛ in. diameter, with upset ends and nuts, bearing against pieces of rail and through oak blocks bearing against the edges of the tie plates of the chord sections.

On the morning of April 22 the operation of lifting the toggle joints began; there were 24 toggle rods, and the work of turning up the nuts required several hours of steady work; the joint was finally raised 3.75 ft. above the line of the lower chord. At 4 p. m the steam pipes were connected to the locomotives and a heavy strain put on the clamp; in an hour the adjustment pins at the west end of the upper chords became loose and were taken out; the adjustment wedges in the upper chord at the east end of the span were loosened; the upper chord being now released at both ends, all difficulties were over and the span was practically swung. Night had come, and work was suspended until morning, when the hydraulic jacks in the lower chord at the east end of the span were slackened off and taken out, the wedges were removed, the castings in both chords at the west end of the span taken out and the pins put back in place. The toggle rods and lines were then slacked off, allowing the lower chord to assume its normal position, and the permanent sections of bottom chord were inserted.

During the erection and swinging of the intermediate span the adjoining cantilever arms had been subjected to strains exceeding those due to the loading assumed in proportioning the members, but not exceeding safe limits. Twelve days were spent in swinging this span.

The erection of the channel span completed the continuous superstructure of the Memphis bridge. The floor system was put in, the riveting was continued, and the entire structure was ready for the passage of trains on May 12, when the bridge was formally opened.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The International Engineering Congress is surprising its most hopeful friends in the number and truly international character of the attendance, the quality of the papers and the interest of the discussions. Some of the best men in Europe and America have written papers and are taking part in the discussions. Unlike some of the other congresses this is no gathering of faddists, but it is an event that will add lustre to the World's Fair. The volume of papers presented is enormous, as one may see by consulting the lists printed in the *Railroad Gazette* last week and July 14. Naturally we can give only a very inadequate notion of them by the abstracts that we shall make of a few of them ; it would be quite impracticable to find space for anything like a complete review of this great mass of literature. But it will soon be available in the published transactions of the societies which have charge of some of the divisions, and through the publication by the house of John Wiley & Sons of the remarkable group of papers collected for the Military and Naval divisions.

The Committee on rail sections of the American Society of Engineers has made its report, recommending a series of sections, up to 100 lbs. per yard, practically as heretofore published. About 42 per cent. of the metal is in the head and the sides are straight. The greatest width of head is 2¼ in. In fact, the whole design is substantially in accord with the most recent and advanced practice.

The maximum rate law in Nebraska is suspended, until October at least. Temporary injunctions have been granted by the United States Circuit Court at Omaha, on the petitions of stockholders of the Chicago & Northwestern, the Chicago, Burlington & Quincy, the Union Pacific and the Missouri Pacific roads, restraining the railroads and the State Board of Transportation from putting the law into effect. Merchants at interior jobbing points had also procured injunctions, as they feared that Omaha would have the advantage of them under the tariffs which would be issued under the law. The law was passed by the last legislature of Nebraska in April and was to go into effect Aug. 1. The petitions all follow the same general line. They set forth that the law is unconstitutional in that it attempts to interfere with rates already under the supervision and regulation of Congress ; that it is class legislation, in that it applies to some of the roads and not to others ; that the provisions of the act confuse and transpose the duties of the judicial and executive officers of the state ; that it was not properly engrossed, and is therefore void ; that it in effect confiscates the property of the petitioners, stockholders residing without the state, for public use without compensation. The Union Pacific stock holders set up that their road is a federal corporation and not subject to the control of the state legislature. The hearing of the cases is set by the Federal Court for Oct. 2, and the present decisions are very brief, not going into particulars at all. In view of the conflicting interests it is idle to predict what the outcome will be. The faulty technicalities which the complainants mention would seem to be sufficient to kill the bill, but if the railroads present their evidence in proper shape they can probably make a conclusive argument on the main issue, that any decrease of rates will imperil the integrity of their properties. The plain fact is that no railroad in Nebraska has any moral right to reduce its rates except where there is a fair prospect that such reduction will result in an early increase of net earnings, for every road needs many thousands of dollars for improvements, and most of them need this money badly. But of course no legislative enactment can be made to reduce those rates which ought to be reduced and let alone those which will not stand reduction, for the reducing process is complicated and troublesome, often requiring tentative changes in tariffs and other temporary expedients. It ought to be practicable to convince the Court of these facts, though it would be futile to think of convincing a state-house full of grangers.

Several Wootten boilers have exploded recently on the Reading, and so far as can be learned the causes of the explosion are about equally divided between bad inspection and hot crown sheets. The proposal to use a Belpaire top will tend to reduce the number of broken stays, provided the stays are properly put in ; but no type of boiler having screw stays will be free from broken ones when the stays are of bad material and improperly made and inserted. At the time of one of the explosions of a Wootten boiler on the Reading road, an observer picked up quite a number of staybolts that had been broken off in both sheets. The breakage in one sheet took place before the explosion and the breakage in the other sheet took place at the time of the explosion. The staybolts were so brittle at the point of connection with the sheet that they could easily be knocked off without bending. It is not to be supposed that a boiler having so many staybolts as there are in a Wootten boiler will get along without systematic and rigid inspection. Certainly it will cost more to keep up the screw stays in a Wootten boiler than in a boiler having a less number of stays ; but this does not make it impossible to maintain a Wootten boiler so that it will not explode. Nothing is more reckless in the care of locomotive boilers on the part of roundhouse foremen than the neglect of the examination of screw stays. If a considerable number become broken in any spot, the adjacent ones will go very rapidly. It is not uncommon to hear of cases where the first notice of broken staybolts was the bulging of a flat sheet. This could only arise from neglect on the part of those who have charge of the boilers. The determination of broken stays is a comparatively easy matter, and if telltale staybolts or hollow staybolts are used all breakages will be revealed. So far as the construction of the Wootten boiler is concerned, either of the radial stay or Belpaire type, there is nothing about it that is weak or unmechanical or expensive to maintain. With such care as other locomotive boilers get and with the use of hollow stays or telltales, such explosions as have occurred could have been prevented. Lack of inspection and improper staybolts and badly fitted staybolts are the main causes of the recent explosions. Generally where the Wootten boiler has been used it has been successful and no more liable to explosions than other locomotive boilers. So far as the Belpaire design is concerned, it has the advantage of the stays being at right angles to the sheets, but the Belpaire top will not reduce the number of explosions if the boilers are not properly inspected, the staybolts properly fitted, and hollow bolt or telltale holes used.

The Financial Situation.

For a year and more business men have been watching for financial trouble, and for a much longer time they have been warned that there was danger. The trouble is now upon us, in spite of the proverb "that a panic expected does not come." For the first five months of the year the feeling was of apprehension rather than fear, and there was certainly no general interruption to production and commerce, in spite of such apprehension, the certain result of which is to make men cautious, leading manufacturers to produce only what they feel pretty sure they can sell, and promoters of new enterprises to postpone to a more promising opportunity the construction of new factories, buildings, railroads and the like. And there cannot have been for some time past an excessive investment in enterprises of this kind, which always absorb the larger part of the savings of this country and usually a considerable amount of the savings of other countries. Railroad construction, it is well known, has been unusually light for this country for several years, the miles constructed yearly having been ;

1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.
2,984	8,037	12,879	6,925	5,193	5,498	3,898	4,090

We have already paid the penalty, or thought we had, for the excessive construction of 27,850 in the three years from 1886 to 1888, as shown in the reduction in the profits of such companies as the Rock Island, the Chicago, Burlington & Quincy, the Atchison and the Missouri Pacific ; and we do not think any one will attribute the present condition of affairs to such cause, which had a great deal to do with the terrible and long-continued depression following the panic of 1873, with the declines culminating in something like a panic in 1884, and with the reduction of values after 1887.

In some kinds of manufacturing business, doubtless, the expansion of productive capacity lasted long after the last period of heavy railroad construction had expired, notably blast furnaces ; but the expansion seems to have been warranted in many cases ; the consumption of pig iron was continued close to the highest point ever known even during the first half of this year ; and we think most manufactories have been fairly well employed until the financial stringency threatened them with the loss of means to go on with as well as with the loss of a market ; that is, their troubles seem a consequence and not a cause of the financial troubles.

With regard to the construction of houses and other buildings, which may absorb immense sums, it also continued to be active long after railroad construction was reduced. There are nothing like complete statistics of such construction ; but we believe that in several of the leading cities it has been unusually large for a few years past. But we do not hear that it has been generally excessive. The new structures, we think, have generally found tenants, and if there have been some towns with "booms" which have come to an untimely end, they do not in the aggregate have a great effect on the whole business of the country.

Railroad earnings kept up very well during the first half of the year. Imports, it is known, were exceptionally large; and as the community has had the financial danger-signal flying in its face for months, it is difficult to believe that it has taken this great amount of goods unless it could afford to. Imports, of course, are but a small part of the total consumption. What is still more significant is the westbound movement of freight on the trunk lines—to our mind the most significant single indication of the condition of the country at large. This movement was fully as large in the first half of this year as in the corresponding period of last year or of any other corresponding period when there were no abnormal influences to affect traffic; and this in spite of an important decrease in June, when the financial troubles were having their effect.

The extremely low price of wheat is a serious misfortune for many; until recently it has not greatly affected the farmers, last year's crop being mostly in dealers' hands; but the new crop now coming forward (winter wheat) is an unusually small one: and the farmers have had a serious time of it, without this new affliction.

On the whole, we are unable to see where the *industrial* condition of the country is seriously at fault. The producers, the carriers and the merchants seem to us to have conducted their business with reasonable sanity of late. By a process of exclusion we are led to attribute our troubles to a financial condition not superinduced by the industrial condition. We are not doctors in finance, and we shall not attempt to prescribe for its present distemper; nor shall we prophesy the result of any treatment of it. It would seem that if health were restored in that department, we ought to be able to go on much as before. But we have seen how serious the results of a lack of confidence may be; and possibly it will be some time after we really get well of that ailment before we believe it and act on that belief. But it seems to us absurd to liken the condition of things now with that in 1873.

The *Railroad Gazette* of Dec. 27, 1873, in a review of the year then closing, said :

"In this country railroad business to a very large extent consists of railroad construction. This has been especially the case since the war, in which period of eight years we have constructed about 36,500 miles of railroad, which is a little more than half of the total mileage of the country. During the last eight years we have built as much railroad as during the preceding thirty-five, and four-fifths of this amount—two-fifths of all now completed in the country—has been built within the past five years, during which we have constructed 29,000 miles of new railroad—a work never equaled or approached in any other country."

To make a comparison of that period, twenty years distant, with this, we must remember that the population by the Census of 1870 was 38.6 millions ; by the

Census of 1890, 62.6 millions—that is, there are 24 millions (60 per cent.) more people in the country now than then.

Increased Tractive Power on Existing Elevated Railroad Structures.

The experience of the "Alley" elevated road in Chicago shows very conclusively that six, seven, and even eight-car trains are readily handled, so far as loading and unloading are concerned, whenever the platforms are made of suitable length. This is practically a demonstration that the capacity of existing elevated roads can be increased materially by hauling a greater number of cars at the hours when more capacity is needed.

In Chicago, for instance, the number of trains that can be sent out from Congress street in an hour is limited to the delivery of a single stub terminal. The headway so far has been about 2½ minutes. With a six-car train this accommodates about 500 passengers each 2½ minutes, or 14,400 passengers an hour. With eight-car trains it would be 19,200 passengers an hour. The only extra cost of hauling the greater number of passengers lies in the increased number of guards on the trains and some additional expense for fuel. The increased fuel used is not in proportion to the increase in train, being much less; so that the total train expense per passenger is materially decreased by using the longer train. The result then is a decrease in train expense per passenger, and increase in total capacity by using more cars per train.

To make the same time over the road this requires a heavier engine, as elevated railroad motors are, as a rule, worked to their full capacity. In Chicago their capacity is about seven cars per train. So far as the structure is concerned, it is not strained practically any more by a longer train than by a short one, except perhaps on curves, but as the trains are allowed to float around the curves at a slow speed, probably no greater strain would be produced there. The limit of train length with the present form of steam motor lies in the limit of weight that can be made available for adhesion on the locomotive. The locomotives in New York weigh about 47,000 lbs.; in Chicago about 58,000 lbs. If all of the weight of the Chicago engines could be made available for adhesion, the locomotives would be sufficiently powerful to haul at least nine cars per train. The steam supply is quite sufficient on those engines for the increased work that would be demanded. As the engines are designed, they have trucks under the tank which carry about 18,000 lbs., or nearly one-third of the total weight. This weight is useless for adhesion, and is, in fact, a dead weight that has to be carried without serving any really useful purpose.

This explains the preliminary facts relating to the point we wish to bring out, which is that the existing elevated railroad structures could be made to carry much longer trains by a proper arrangement of the weight of the locomotive.

Our readers may remember that in the *Railroad Gazette* of May 5 was illustrated a Mallet compound locomotive designed for the Swiss Central Railroad. This locomotive was not intended for elevated railroad use, and perhaps in many of its details would not be adapted for that work, but it has some features that are worth the consideration of those who wish to increase the carrying capacity of existing elevated railroads. The main advantages lie in the fact that all the weight is available for adhesion. A locomotive of the Chicago type built on this principle would weigh about 65,000 lbs., and would have on each pair of drivers about 32,500 lbs., and would be capable of hauling about 10 cars of the ordinary elevated type, and would have less weight per running foot than the engines now used, even in New York City.

The conclusion is, then, from this limited argument, that, by substituting steam motors having all the weight available for adhesion, longer trains, say eight cars, could be hauled on existing elevated roads. If this is logical, and if there are no reasons why such a step could not be taken, then it is worth while making a further investigation into the subject. The lesson taught by the success of the Chicago road with its increased motive power is a valuable one. It is practically that longer trains can be handled on an elevated road with perfect facility, and quicker time can be made than is common on elevated roads. The compound engine has shown itself to be well adapted for elevated work, and the Westinghouse automatic air-brake works with perfect satisfaction; perhaps it is the brake as much as anything else that enables quicker time to be made; but whatever be the reason, it is a fact that six and seven car trains can be handled with satisfaction, both to the public and the railroad company. Before radical steps are taken, if ever they are, to modify existing structures of elevated roads, it should be seriously considered whether longer trains would not be more profitable than the five-car trains now run.

June Accidents.

Our record of train accidents in June, given in this number, includes 72 collisions, 96 derailments and 5 other accidents, a total of 173 accidents, in which 40 persons were killed and 200 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

COLLISIONS:	Rear.	Butting.	Crossing and other.	Tot'l.
Trains breaking in two	10	0	0	10
Misplaced switch	0	2	2	4
Failure to give or observe signal.	4	1	2	7
Mistake in giving or understanding orders	0	6	0	6
Miscellaneous	11	3	7	21
Unexplained	6	6	12	24
Total	31	18	23	72

DERAILMENTS:			
Broken rail	5	Runaway train	1
Loose or spread rail	3	Bad loading	2
Defective bridge	2	Derailing switch	1
Defective switch	5	Bad switching	2
Defective frog	1	Animals on track	6
Broken wheel	3	Landslide	1
Broken axle	7	Washout	5
Broken truck	1	Malicious obstruction	3
Fallen brakebeam	1	Accidental obstruction	2
Failure of coupling or draw-bar	2	Unexplained	36
Boiler explosion	1		96
Misplaced switch	6		

OTHER ACCIDENTS:	
Broken side rod	1
Cars burned while running	2
Other causes	2
	5
Total number of accidents	173

A general classification shows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.	P.c.
Defects of road	0	16	0	16	9
Defects of equipment	10	15	1	26	15
Negligence in operating	38	12	2	51	30
Unforeseen obstructions	0	17	2	19	11
Unexplained	24	36	0	61	35
Total	72	96	5	173	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.
Passenger	25	27	3	55
Freight and other	111	70	2	183
Total	136	97	5	238

The casualties may be divided as follows:

KILLED:	Collisions.	Derailments.	Other accidents.	Total.
Employés	13	12	0	25
Passengers	0	7	0	7
Others	5	3	0	8
Total	18	22	0	40
INJURED:				
Employés	57	47	0	104
Passengers	20	61	0	81
Others	12	3	0	15
Total	89	111	0	200

The casualties to passengers and employés, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road	0	26	2	11
Defects of equipment	0	0	0	2
Negligence in operating	7	42	15	63
Unforeseen obstructions and maliciousness	0	0	7	14
Unexplained	0	13	1	14
Total	7	81	25	104

Twenty-six accidents caused the death of one or more persons each, and 45 caused injury, but not death, leaving 102 (60 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with June of the previous five years shows:

	1893.	1892.	1891.	1890.	1889.	1888.
Collisions	72	75	50	64	33	64
Derailments	96	88	109	67	42	76
Other accidents	5	2	8	6	4	3
Total "	173	165	167	137	79	143
Employés killed	25	44	50	41	18	30
Others "	15	26	10	17	17	10
Employés injured	104	143	130	98	49	67
Others "	96	156	107	155	53	58
Passenger trains involved	55	77	58	65	36	51
Average per day:						
Accidents	5.77	5.50	5.57	4.57	2.63	4.76
Killed	1.33	2.33	2.00	1.93	1.17	1.33
Injured	6.67	9.97	7.90	8.43	3.40	4.17
Average per accident:						
Killed	0.231	0 424	0.359	0.423	0.443	0.280
Injured	1.156	1.812	1.419	1.847	1.291	0.874

The record of passengers killed in June would have been represented by zero had it not been for the disaster at Parkville, L. I., on the 20th, which many railroad officers would almost be ready to exclude from the record, for the reason that it occurred on a "summer" railroad where the arrangements, in some important features, are hardly up to the regulation standard, as that is generally understood. The use of open cars is a chief one of these features, and the circumstances of the accident certainly are such that one hesitates to compare the American accident record (with cases of this kind included) with that of England, without making special note of the unequal conditions. There are some railroads in the United Kingdom which are rather primitive, not to say deficient, in safety appliances and regulations; but, on the other hand, both there and here the managers of regular railroads whose equipment or facilities are deficient very fully recognize their duty to run trains at very low speeds. Regarding the cause of the Parkville disaster the New York State Railroad Commissioners have made a report in which they say:

From the testimony the Board is forced to the conclusion that McGarry, the switchman, was dozing in his cabin before the accident, and that being awakened suddenly he grasped the levers and turned the switch under the train. . . . The neglect of the signal foreman, John Sanderson, to make sure that the detector bar was in place [it had been taken off during the winter, when only two trains a day were run], and the action of McGarry, were the causes of the accident.*

The missing detector bar was placed upon the switch the next day. The tower man was accused by plausible witnesses of being asleep (though other circumstances support his denial) and the newspapers came out with their regulation expressions of horror about a switchman asleep at his post. In view of the circumstances of this case, the switch out of sight of the cabin, and not fitted with a detector bar, perhaps the newspaper writers cannot be blamed for lack of discrimination, but it seems in order to once more remind them that in all properly designed switch and signal plants the attendant can do no serious harm by going to sleep. He can produce delay, and perhaps much inconvenience, but cannot lead a train into danger. We discussed this accident in our issue of June 23. The facts since brought out do not afford any ground for changing the conclusions then expressed.

A brakeman was killed near Summit, S. D., on the 16th by a collision which, although not caused by anything connected with the air brakes, was much more severe in consequence of the fact that they were in operation on the train. We make special mention of this case because this is a kind of accident which is liable to happen on almost any road nowadays. It will be well to follow the records from month to month, for these accidents are not likely to be frequent on any one road, and a long period of immunity may lead to relaxation of vigilance in inspection of drawbars and couplings.

At Avondale, N. J., on the 24th, the wrecking of a carriage by a train at a highway crossing resulted in the death of five persons; at Crawfordsville, Ind., on the 17th, three were killed in the same way; at Philadelphia on the 23d, two, and at Chicago on the 27th, two were killed and two injured. A horse car was struck by an engine of the Rock Island road in Chicago on the 2d, and a woman was killed. In Dayton, O., on the 12th, a passenger in a street car was killed in the same manner

Marc Seguin and the Multitubular Boiler.

Letters printed in the *Railroad Gazette* some weeks ago referred to the invention of the multitubular boiler in connection with George Stephenson's "Rocket." It is difficult to see how the credit for this invention can be denied to the Frenchman, Marc Seguin. He invented the tubular boiler in 1825, and shortly afterward built a steamboat for navigating the Rhone, with three boilers, each with 80 tubes 4 centimetres (1.6 in.) in diameter, and 3 metres (10 ft. long, and as early as 1827 he had locomotives constructed with such boilers. About 1826, before the "Rocket" was built, he visited England to inspect the Stockton & Darlington Railroad, and made the acquaintance of Stephenson, and on his return obtained a charter for the first railroad in France, from Lyons to St. Etienne, 35 miles long, on which his multitubular boilers were used, developing, his biography claims, a steam-producing capacity per hour *six times* as great as any locomotives built previously. The great improvement which Stephenson made on this boiler was the use of the exhaust steam to force the draft—as important, perhaps, as the multitubular boiler; but it is the two together which have made the locomotive the success which it became immediately after the trial at Rainhill, and Seguin should not be deprived of his share in the work.

Seguin was by no means an obscure man, and the facts in his career are well known. He lived until 1875, dying then at the great age of 90. But his career as an engineer ceased soon after he built his railroad; for he had a consuming thirst for scientific study, and after he had acquired a competency devoted himself to it with success and credit. As early as 1839 he declared, substantially, what seems to most of us a recent discovery, that heat is "a mode of motion." "A veritable identity exists," said he, "between heat and the mechanical power which it serves to develop, and these two effects are only the manifestation apparent to our senses of one and the same phenomenon." But the discovery of this principle he credited not to himself, but to Joseph Montgolfier, at the close of the last century.

Seguin was descended from a family which emigrated from Alexandria, Egypt, to France, in 1598. His mother

* The Board recommends:
First—That the Long Island Railroad Company widen the tunnel at this point, do away with the interlaced tracks and lay two separate standard gauge tracks through it. . . . Second—That if the interlaced tracks must be used, a full stop at home signals shall always be made by all trains. Third—That all open cars be closed on the sides at least half-way up from the floor with some form of wire netting; that the long side steps be taken off; that entrances be made in the ends the same as in closed cars; the seats to remain as now with the exception of a suitable aisle running through the car. Fourth—That three men be on duty in the switch tower at this point during the twenty-four hours, eight hours each, during the continuance of the summer time card. The Board will issue an order to every steam road in the state on which open cars are operated, recommending that all open cars be closed on the sides and otherwise protected as provided in th third recommendation.

was a sister of Joseph Montgolfier, Member of the Institute, the inventor of the balloon, and Seguin was educated under his direction; and in early life made a severe study of mathematics, physics, chemistry, astronomy, etc. He would probably never have left the pursuit of pure science if his means had permitted. His first business venture was the manufacture of felts for paper mills, while conducting which he made important improvements in turbine wheels. In 1823 he constructed at his mill what is claimed to have been the first *wire* suspension bridge—a sort of toy affair, 58 ft. long, and only 20 in. wide—said to have cost little more than $10; the next year he built another, and presented to the government a plan for a wire suspension bridge over the Rhone. He and his brother were authorized to build such a bridge on their own account, between Tain and Tournon, which they completed by Aug. 25, 1825. He published a memoir on wire suspension bridges in 1822. Going to Geneva in 1823 to plan a suspension bridge, he saw for the first time a steamboat, built by an American named Church. This led him to establish a steamboat line on the Rhone, between Lyons and Valence, which was not very successful as a commercial venture, but doubtless led to his invention of the multitubular boiler.

In 1839 Seguin published a work on the "Influence of Railroads and the Art of Locating and Constructing Them," which made a great sensation at the time, and shows very clear comprehension of many fundamental principles since demonstrated by experience. This work has recently been reprinted by one of his twelve children as a monument to his memory, which deserves the attention of those who are interested in the history of railroads. It contains two photographs of him, showing a superb head.

After his retirement from active business he was made a corresponding member in the section of mechanics of the French Institute, and contributed to it a large number of scientific papers, the latest of which is dated 1867.

Some of the judges in the Transportation Department of the World's Fair have been appointed. The transportation division includes railroads, railroad plants and equipment, Group 80; street car and other short line systems, Group 81; miscellaneous and special railroads, Group 82; vehicles and methods of transportation on common roads, Group 83; aerial, pneumatic and other forms of transportation, Group 84; vessels, boats, marine, lake and river transportation, Group 85; and naval warfare and coast defence, Group 86. The general committee of judges on transportation exhibits (Department G) is as follows: President, Herman von Littrow, Austria: First Vice-President, Prof. Francis Elgar, Great Britain; Second Vice-President, Captain Coucas y Palau, V. M., Spain; Secretary, Prof. Alex. Oldrini, Italy; Assistant Secretary, James N. Lauder, United States. Among the judges thus far appointed are: Signor C. A. Barrattoni (Italy), Herr A. von Borries and A. Haarmann (Germany), Robert Hudson (New South Wales), E. M. Herr, L. F. Loree, J. N. Lauder, Charles Paine and Prof. W. F. M. Goss. The subcommittee on air-brakes is composed of E. M. Herr, Prof. Wm. F. M. Goss and Herr von Borries. This committee has been at work for several days examining the air-brake exhibits. Only a general examination will be made at present. This is in order to make the members familiar with the different designs displayed and all the latest improvements of each. It has not yet been decided whether to make record tests or not. The members of the committee fully appreciate the difficulty of comparing tests made on racks of different design, some with train-pipe straight, and others with many bends, piping of different lengths and different recording apparatus for each; and if tests are to be made, they will be made later and under the same conditions for each.

The British Board of Trade has just issued its report of what it did as a tribunal of conciliation between railroads and their customers between August, 1891, and Jan. 1, 1893, about a year and a half. It will be remembered that under Section 31 of the Railway and Canal Traffic Act of 1888, the Railroad Department of the Board of Trade has powers similar to those of the Interstate Commerce Commission and of the Massachusetts and some other state commissions in this country, in the matter of hearing complaints and recommending remedies concerning unreasonable rates or other discriminations by the traffic departments of railroads in dealing with the public. This report covers the business up to the date when the present maximum rate laws went into effect, and it gives a condensed description of each of the 45 cases that were dealt with during the term covered by the report. Since the act went into effect, five years ago, the Board has dealt with 152 cases, of which 52 were settled more or less to the satisfaction of the complainants, 49 were dropped by the complainants after some explanation, and 52 were either rejected by the Board of Trade, or decided to be questions of law, and, therefore, to be dealt with only by the courts. The present report is compiled by Sir Courtenay Boyle, who says that continued experience has only served to strengthen his high opinion of the wisdom of this method of dealing with complaints against the railroads. He adheres to the view that this tribunal should not attempt to perform any of the functions of a court of law, and repeats a former statement that "the strength of this plan lies in its weakness." As long as the Board is powerless to adopt coercive measures, both parties come to it in a conciliatory spirit.

NEW PUBLICATIONS.

Local Engineering Data for St. Louis.—This little pamphlet of 50 pages, recently issued by the Engineers' Club, of St. Louis, consists of a valuable compilation of the *local conditions* and *local materials* of interest to the engineering profession in that city or having business there. The first part deals with geodetical and geological data, climate, cost of earth borings, etc.; and the second part tells of the resources of the region in stone, cement, timber, etc., with a large amount of information about sewers, iron and other materials fuels, etc. The price of the book is 75 cents, bound in paper, and $1 bound in cloth.

Sixth Annual Report of the Interstate Commerce Commission, Dec. 1, 1892.
Fourth Annual Report of the Statistics of Railways in the United States; for the year ending June 30, 1891. Prepared by the Statistician to the Interstate Commerce Commission. Washington: Government Printing Office.

These two volumes issued from the office of the Interstate Commerce Commission have just appeared in final form, but both have been reviewed from advance sheets in previous issues of the *Railroad Gazette.*

Poor's Manual for 1893. New York: H. V. & H. W. Poor, 70 Wall street.

We gave last week extracts from the introduction to Poor's Manual for 1893, giving the principal statistics of the railroads of the United States at the end of 1892 The complete volume is now received, and some of the more important tables are reproduced in another column. There is nothing in the introduction to indicate any new features in this year's volume and we discover none, and of course it is not necessary to describe the character and scope of the work.

Massachusetts Institute of Technology.—An elegant pamphlet, illustrated by numerous direct-process cuts of the various buildings and rooms, has been issued, giving a brief account of the character and equipment of this institution, for circulation at the World's Fair. Copies may be had by addressing the Secretary, Dr. H. W. Tyler, at Boston.

TRADE CATALOGUES.

General Catalogue of Worthington Pumping Engines, Steam Pumps and Hydraulic Machinery. July 1, 1893.

The catalogue issued by Henry R. Worthington under this date is a convenient pamphlet of 104 pages with an alphabetical index and telegraphic code. It contains illustrations of the pumping station and some of the Worthington machinery at the World's Fair, besides illustrations and tabulated data of the product of these works. It is unnecessary to say that a great variety of high-class hydraulic machinery is shown.

Cableway Sketches.—The Lidgerwood Manufacturing Company, 96 Liberty street, New York, has issued a pamphlet of 64 pages describing its apparatus for cable transportation, illustrated by 50 or more cuts and half tone engravings. The pamphlet is chiefly devoted to accounts of dams and quarries in which the Lidger wood cableways were used. The Sodam, Austin, Butte City and Coosa dams are illustrated. With these cableways loads are transferred over 1,200-ft. spans. The heaviest weight yet handled is 12 tons on a span of 800 ft.

E. W. Bliss Co., Brooklyn, N. Y.—The various machines made by this well known firm are described for World's Fair visitors in a series of five catalogues, referring respectively to double crank power presses toggle joint drawing presses, open back power presses, Stiles punching presses and Stiles drop hammers. These pamphlets are printed on heavy paper, and each machine is illustrated in a variety of styles. The descriptions are printed in English, French and German, as are also the price lists.

Electric Motors, made by the Siemens & Halske Electric Company of America. The well known German firm of Siemens & Halske, which has a Chicago office, as ndicated by the title of this pamphlet, issues an illustrated description of its electric motors for all classes of machine work. The application of small motors direct to machines has been introduced by this firm extensively, and it has large factories at Charlottenberg, Germany, in which there is not a foot of shafting in service.

The Railroads of the United States in 1892.

We published last week, page 569, some of the most important general data from Poor's "Manual" for 1893, just issued. Below will be found certain tables of present interest or of frequent use for reference:

LIABILITIES AND ASSETS OF COMPANIES OWNING 171,863.29 MILES.

Liabilities.		*Assets.*	
Capital stock....	$4,920,555,225	Cost railroad and equipment.....	$9,375,314,005
Funded debt.....	5,463,611,204	Re'lest'te, st'cks, bonds & other investments....	1,629,243,371
Unfunded debt....	285,871,888	Other assets.....	257,957,074
Current debt.....	418,935,289	C'rrent acco'nts.	219,070,432
Total liabilities.	$11,088,933,606	Total assets....	$11,481,584,882

STATISTICS OF OPERATIONS, FISCAL YEARS ENDING IN 1892.

Miles of railroad operated (exclusive of elevated railroads).....	170,606.84		
Pass'ng'r train mileage.....	323,930,550	Passengers carried.....	575,769,678
Freight train mileage.....	523,831,458	Passengers—mileage.....	13,697,343,804
Mixed train mileage	17,148,455	T'ns fr'ght mov'd.	749,331,860
T't'l revenue train mileage.....	864,910,463	T ns freight m'v'd one mile.....	84,448,197,130

Earnings:		*Payments from Revenue:*	*Available*
Passenger	$293,557,476	Int'r'st on b'nds	$232,659,089
Freight.....	816,716,759	Other interest..	3,600,799
Other.....	81,582,864	Dividends	83,336,811
Elevated railroads.....	13,414,924	Rentals, tolls, etc.....	62,553,445
Total traffic revenue	$1,205,272,023	Miscellaneous..	32,711,558
Operat. expenses.	846,633,503	Total.....	$417,861,702
Net earnings.	$358,638,520		
Other receipts, including rentals received by lessor companies..	114,619,545	*Balance:* Excess of available revenue over actual p'ym'nts th're from for the year.....	$55,396,363
T't'l available revenue	$473,258,065		

PASSENGER TRAFFIC FOR ELEVEN YEARS, 1882-1892.

Year.	Length of r'lro'ds in operation.	Miles run by passenger trains.	Passenger traffic.		Passenger earnings.					Ave. No. of passengers per mile of railroad.	Ave. No. of passenger-miles per pass. train-mile.	Average distance traveled per passenger.
			Passeng'rs carried.	Passenger movement.	Gross amount.	Ave. rec. per pass. per mile.	Ave. rec. per passenger.	Ave. rec. per pass. train-mile.	Ave. rec. per mile of R. R.			
	Miles.		No.	Miles.	$.	Cents.	Cents.	Cents.	$.	No.	Miles.	Miles.
1882	95,752	165,438,158	289,030,783	7,688,468,538	188,137,462	2.447	65.09	113.72	1,964	3,018	46.47	26.60
1883	106,938	187,903,247	312,686,641	8,541,309,674	206,837,256	2.422	66.14	110.07	1,934	2,923	45.45	27.31
1884	113,173	206,516,118	334,570,766	8,778,581,061	206,790,701	2.356	61.87	100.13	1,827	2,956	42 50	26.24
1885	122,110	211,587,620	351,427,688	9,133,673,956	200,483,941	2.198	57.16	94.94	1,645	2,877	43.16	25.99
1886	125,146	210,637,392	382,284,972	9 659,698,294	211,929,857	2.194	55 43	100.61	1,693	3,054	45.85	25.27
1887	136,986	238,755,920	428,2.5,513	10,570,306,710	240,542,876	2.276	56.17	100 75	1,756	3,126	44.27	24.68
1888	145,341	268.125.34	451,353,655	11,190,613,679	251,356,167	2.246	55.68	93.74	1,729	3,105	41.73	24.79
1889	153,689	279,085,145	494,808,421	11,964,726,015	259,439,231	2.169	52.44	92.96	1,688	3,219	42.87	24.18
1890	157,976	297,244,707	520,439,082	12,521,565,649	272,320,961	2.174	52.13	9..61	1,724	3 294	42.12	24.05
1891	164,262	320,712,013	556,015,802	13,316,925,239	290,799,696	2.184	52.30	90.67	1,770	3,385	41.52	23.95
1892	170,607	323,930,550	575,769,678	13,697,343,804	293,557,476	2.143	50.99	90.62	1,721	3,375	42..9	23.79

FREIGHT TRAFFIC FOR ELEVEN YEARS, 1882-1892.

Years.	Length of R.R's in operation.	Miles run by freight trains.	Freight traffic.		Freight earnings.					Average No. of tons per mile of railroad.	Average No. of ton-miles p. freight train-mile.	Average haul per ton.
			Freight carried.	Ton-miles.	Gross amount.	Av. receipts per ton p. mile.	Av. rec. per ton.	Av. rec. p. freig't train-mile.	Av. rec. per mile of R. R.			
	Miles.		Tons.	Miles.	$.	Cents.	Cents.	Cents.	$		Miles.	Miles.
1882	95,752	305,118 035	560,490,375	39,202,209,249	485.778,341	1.236	134.75	159.21	5,074	3,764	128.81	109.02
1883	106,938	350,108,255	600,453,439	44,061,923,445	539 509,831	1.224	134.72	154.09	5,045	3,744	125.86	110.04
1884	113,172	334,814,529	599,074,749	44.725,207,677	502,869,910	1.125	126.00	150.19	4,443	3,526	133.58	112.07
1885	122,110	342,288,770	637,140,099	49.151,894,469	509,690,992	1.036	116.62	148.91	4,174	3,578	143.5	112.46
1886	125 146	349,697,537	682,245,254	52,802,070,529	550,35.,014	1.042	112.05	157.34	4,397	3,853	150.99	109.49
1887	136,986	394,191,107	752,074,752	61,561,069,996	636,666,223	1.034	115.32	161.51	4.647	4,030	156.16	111.51
1888	145 341	410,514,115	790,857,353	65,423,005,988	639,200,723	0.977	108.18	155.71	4,398	4,065	159 36	110.72
1889	153,689	429,469,737	6 9,165,630	68,677,276,992	665,962,331	0.970	107.55	155.06	4,333	4,029	159.91	110.90
1890	157,976	482,900,422	691 344,437	79,192,985,125	734,821.733	0.927	106.28	152.17	4,651	4,376	163.99	114.55
1891	164.262	493,541,969	704,398,609	81,210,154,523	754,185,910	0.929	107.07	152.81	4,591	4,288	164.55	115.29
1892	170,607	523,831,458	749,331,860	84,448,197,130	816,716,759	0.967	108.99	155.91	4,787	4,392	161.21	112.70

EARNINGS, INTEREST AND DIVIDENDS FOR ELEVEN YEARS, 1882-1892.

Year.	Gross earnings.	Net earnings.	Total available revenue.	Payments from available revenue.		Earnings per mile of railroad.		Expenses to earnings.	Interest paid—on total b'nded debt.	Div'nds paid—on total share c'pital.
				Int. on b'ds.	Dividends.	Gross.	Net.			
								P. c.	P. c.	P. c.
1882..	$727,987,310	$264,818,769	$315,663,925	*$143,767,726	$97,159,519	$7,377	$2,670	63.61	....	2.91
1883	807,112,780	291,587,588	359 942.327	*171.414,2?8	101 579.038	7,461	2.702	68.78	....	2.75
1884.	763,306,608	266.513.911	349.756.172	167.286.179	93,203,835	6,663	2,318	65.21	4.66	2 48
1885..	765,310,419	266.488.993	352,881,470	179,681.323	77.672.105	6.265	2,185	65.12	4.77	2.02
1886..	822,191,949	297,311,615	363,511,704	182,884,990	80,094,138	6.570	2,376	63.84	4.75	2.04
1887..	931.385,154	331.135,676	414.300,031	196,081.610	90,013,458	6,861	2,444	64.45	4.71	2.18
18-8..	950,622,008	297,363,677	38 .261,557	199,062.531	78.913,041	6.540	2.045	68.72	4 35	1.77
1889..	992,046,319	317 963,074	406,767,222	210,268.325	79.531.863	6,455	2,068	67.95	4.10	1.81
1890..	1,078.835,339	341,666.369	449.712.756	217,922.677	83,575,705	6,822	2,162	68 33	4.27	1 80
1891	1,125 534,815	350,867,370	451.917.193	222,652,306	89.099,757	6.852	2,196	68.83	4.25	1.85
1892..	1,191,857,099	352,817,405	467,246,357	229,909,292	81,536,811	6,986	2,068	70.40	4.25	1.68

* Includes other interest.

SUMMARY FOR SEVEN YEARS.

	1892.	1891.	1890.	1889.	1888.	1887.	1886.
Capital stock per mile of completed road	$28,680	$28,641	$28,333	$28,095	$28,763	$28 321	$29,935
Bonded debt per mile of completed road	31,845	31.179	31.244	30,178	29,972	28,290	29.062
Cost of rd. and equipment p. m. com. road	54,644	53,648	53,783	53,740	54,008	52,699	54,301
Passenger earnings p. mile of road in operation	1,721	1,770	1.723	1.688	1,729	1,756	1,693
Freight earnings per mile of road in operation	4,787	4,?91	4,651	4,333	4,297	4,649	4,397
Gross earnings per mile of road in operation	6,986	6.926	6,946	6.524	6,540	6,861	6,570
Net traffic earnings per mile of road in oper	2,068	2,168	2,195	2,095	2,045	2,444	2,376
Percentage of expenses to earnings	70.40	68.83	68.33	67.95	68 72	64.45	63.84
Passenger earnings per passenger train-mile	$0 906	$0.907	$0 920	$0.932	$ .937	$1.008	$1.006
Freight earnings per freight train-mile	1.559	1.528	1.522	1.550	1.557	1.615	1.573
Gross earnings per revenue train-mile	1.378	1.354	1 359	1.374	1.380	1 445	1 443
Gross expenses per revenue train-mile	0.970	0.932	0.929	0.934	0.948	0.931	0.921
Net earnings per revenue train-mile	0.408	0.422	0.434	0.440	0 432	0.514	0 522
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cen t
Passenger earnings—proportion of gross	24 63	25 84	25.24	26.13	26 44	25.82	25.77
Freight earnings—proportion of gross	68.52	67.00	68.12	67.?3	67.24	68.38	66.94
Other earnings—proportion of gross	6.85	7.16	6.64	6 71	6.32	5.80	7.29
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Earnings per passenger per mile	2.143	2.184	2.174	2.169	2.246	2.276	2.194
Earnings per ton per mile	0.967	0.929	0.937	0 970	0.977	1.034	1.042
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Average distance per passenger	23.95	23.95	24.05	24.18	24.79	24.68	25.27
Average haul per ton	112.70	115.29	114.55	110.90	110.72	111.51	109 49
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Interest per cent. of bonds	4.25	4.25	4.27	4.40	4.35	4.71	4.75
Interest per cent. of bonds and debt	4.38	4.10	4.09	4 09	4.17	4.55	4.53
Dividends per cent. of stock	1.68	1.85	1.80	1.81	1.77	2.18	2.04
Interest and div. p. c. of stock, bonds and debt	3.01	3.06	3.04	3.03	3.03	3.40	3.26

The International Engineering Congress at Chicago.

The first session of the International Engineering Congress was opened in Chicago at 10 o'clock Monday morning. Mr. C. C. Bonney, the President of the World's Congress Auxiliary, opened the general session, all sections of the Congress having met together in the preliminary meeting. Mr. Octave Chanute, First Vice-Chairman of the Committee on Engineering Congresses, presided and made a brief address of welcome. He introduced in turn various gentlemen, who spoke briefly for the engineers of their various countries. Sir Benjamin Baker, M. Inst. C. E., represented the engineers of Great Britain and the Institution, and brought also a message from the Smeatonian Society, the oldest organization of engineers in the world. He was followed by the Baron de Rochemont, of France, who represented the French engineers. Mr. C. O. Gleam, of Hamburg represented the associated engineering societies of Germany; Mr. Nyberg, spoke for the Russian engineers, Mr. Capicci for those of Italy, and Mr. von Lithrow for those of Austria. These gentlemen were followed by the chiefs of the various divisions, who made very brief speeches. These were Mr. Wm. Metcalf, President Am. Soc. C. E., Division A, Civil Engineering; Mr. Eckley B. Coxe, President Am. Soc. M. E., Division B, Mechanical Engineering; Mr. Henry M. Howe, President Am. Inst. of M. E., Division C, Mining Engineering, and Division D, Metallurgical Engineering; Prof. I. O. Baker, University of Illinois, Division E, Engineering Education; Maj. Clifton Comly, U. S. Army, Division F, Military Engineering; Commodore George W. Melville, U. S. Navy, Division G, Marine and Naval Engineering.

At about 11:30 the various divisions organized in different halls for the purposes of their respective conventions. The list of papers to be presented at the Congress is very long and the titles and authors have already been published in these columns. Of course it is quite impracticable to attempt to give even brief abstracts of all of them; therefore we shall give only those which appear to be for one reason or another of the most immediate interest.

The papers presented in Division A at the session of Monday were Navigation Works in France, by M. Guillain; Common Roads, Railroads and River Communications in Portugal, by Mr. Pimental; the Rearrangement of the Altona Terminal, by Mr. Caeser. There was no discussion of these papers, and the meeting adjourned early in order that those present might visit the World's Fair.

In Division B no papers were presented. Some routine business was transacted, and the meeting adjourned for a water excursion to the World's Fair and a visit to the Worthington plant installed there in various places.

DIVISION A.—CIVIL ENGINEERING.

The first paper presented at Tuesday's meeting of Division A was a remarkably valuable one by Mr. Geo S. Morison on the Continuous Superstructure of the Memphis Bridge. Some portions of this paper are presented in this issue, and others will be given next week. There was considerable valuable discussion of the paper.

Mr. G. H. THOMSON brought up the matter of the lack of provision in modern bridge designs for structural motion. Bridge engineers are quite familiar with Mr. Thomson's notions on this subject, which is one of his hobbies.

Mr. GOLDMARK agreed with Mr. Thomson as to the insufficient consideration in bridge designs of the vibrations to which the structures must be subjected by passing loads. In some of his own experience he had found that riveted connections endure better than suspended floor systems, and so of other parts of the structure. He is of the opinion that too much attention is paid to the requirements of the theoretical strain sheet and too little to the design of details, and Mr. Thomson indorsed Mr. Goldmark's views, saying that the cultus of the strain sheet has come to be a sort of engineering superstition.

Sir BENJAMIN BAKER, in critical examinations of old wrought iron bridges which he had dissected, had found that they suffered most in the connections and not at the places where the strain sheets would indicate the greatest fatigue. He had found, for example, in bridges with trough flooring, now so much used in England, that the failures were serious where the flooring was connected to the webs of the main girders. He has seen the web plates nearly cut through by the wriggling of the connections, and finds that it is better practice to put the troughs directly on the top of the angle plates. And so with other riveted parts: he had found the greatest wear from the loosening of the rivets.

He mentioned also the fact that many parts are subjected to internal stresses quite up to if not exceeding the elastic limit. Stresses as great as 22,000 lbs. to the square inch occur from this cause, and it is a dangerous source of fractures. So in gun steel that he had examined, he had found the fractures beginning in the middle of the thickness of the metal and ultimately extending to the surface.

Mr. ROBERT MOORE called particular attention to the design of the end bearings of the trusses on the piers, which he considered especially meritorious. In the ordinary bridge structure it often happens that the small rollers get clogged from corrosion and accumulated dirt, and they cease to function and bring severe strains on the superstructure and the masonry. He had lately seen a case of the splitting of the coping on the top of a heavy pier from this cause. Rollers of larger diameter than those usually employed should by provided.

Mr. MORISON said that there are two sources of motion under stress; one legitimate and the other illegitimate. The legitimate source of motion is the change of length of metal due to the stress. The illegitimate comes from lost motion in details; and more harm comes to bridge structures from this cause than from any other. An old bridge was lately taken down, which was of very antiquated design, with cast iron top chord and connections, but the chief wear in it was found where there should theoretically have been no wear at all; that is, on the pins holding the counters at the ends.

Referring to Sir Benjamin Baker's remark about internal stresses, Mr. Morison mentioned his well known practice of drilling bridge pins horizontally through the centers. He was led to do this from having had to condemn pins for piping, and it is now his universal practice. This drilling is useful not only in relieving internal stresses, but in detecting defects in the metal. In one bridge now building he rejected all the pins. They were forged under too light a hammer and the drilling revealed internal defects.

Mr. CHARLES MACDONALD believed that the Memphis Bridge had reached, if it had not passed, the limit of span for the American system of bridge construction. In such an immense structure the difficulties of fitting and especially of transporting the members become very serious, and there is danger of their being so distorted in transportation that they can only be assembled with great difficulty, as was the case with certain parts of the Memphis Bridge.

The papers on the improvement of the North Sea Canal, of Holland, and on projects for this canal from 1629 to 1893, were not presented, the authors not being present.

A paper by Mr. Henry Faija, on the manufacture and testing of Portland cement, and one by Mr. Max Gary, on testing Portland cement and the development of the cement industry in Germany, were also read by abstract. These papers were also discussed at considerable length.

Mr. GRIFFITH, M. Inst. C. E., said that recent questions as to the security of concrete masonary structures made the investigation of the manufacture and uses of cement very interesting to engineers. But notwithstanding the importance of the subject, there are in England no standards of manufacture and testing and there is a great diversity of practice and opinion. He does not agree with Mr. Faija as to the use of coarse cement. It is not likely to be thoroughly burned, and deteriorates by the slow hydration of the coarser particles. Testing by the use of steam and hot water may be useful, but it is desirable to have a material which can be tested by simple methods, available for engineers working where laboratories are not accessible. He had doubts also of the value of sand tests, but fine grinding is an essential element in getting good cement.

Mr. DON J. WHITTEMORE, Past President Am. Soc. C. E., questioned the reliability of hot water tests, and said that American engineers generally like finely ground cements. He suggested the desirability of a system of tests under compression. Cement is used under strains of compression and not of tension, and high tensile strength is not an evidence of its value.

Captain BLACK, M. Am. Soc. C.E., had had some experience with cement concrete in sea water on the coast of Florida. He had used there a concrete composed of cement one part, sand two parts, shell four parts. This was used in an arch exposed continually to the air, in the footing of a sea wall which was exposed to the air and sun at low water, and in test blocks that were continually immersed in the sea water. After two years the concrete in the arch was found in perfectly sound condition, but the sea wall footing and the test blocks which were still good after one year, were found after two years to be soft, spongy and discolored, and he concludes that there is probably a good deal of submerged masonry in this condition. He found that where little pools of sea water stood on the top of the masonry, the concrete became so soft that a knife blade could be easily stuck into it.

Sir BENJAMIN BAKER said that while the literature of this subject would fill a pretty large room, engineers differed very much in their notions of good practice. For example, the specifications of tensile strength required in the tested concrete on the Manchester Ship Canal and on the Liverpool Water-Works are 80 per cent. apart. He had recently made a very careful inspection of some of the concrete masonry on the Manchester Ship Canal, where the cement is tested to 300 lbs. per square inch, and found the masonry in perfect condition. Similarly on the Liverpool Water Works where the specifications require a tensile strength of 540 lbs. to the square inch, the engineers are perfectly satisfied with the results secured. As to the question of testing by compression or tension he said that failures under crushing strains are really failures by shearing and that a high tensile strength indicates a capacity to stand strains of this nature.

Although the papers on the North Sea Canal had been omitted, Mr. Fulscher, Chief Executive Engineer of the North and East Sea Ship Canal and member of the Canal Board, asked the privilege of submitting some verbal discussion. He spoke in German, his remarks being translated by Mr. Gleim.

The paper by Mr. Martin Murphy, on Bridge Superstructure and Foundations in Nova Scotia, was not read, the author not being present.

The very original and interesting paper by Mr. Neukirch, on an improved method of constructing foundations under water, by forcing cement into loose sand or gravel by means of air pressure, was read in abstract by Professor Brush, but was not discussed. The process is so novel and would be so useful if reliable that the gentlemen present regretted that there were not more data given of actual applications of the process. The essential part of this paper will be given in a later issue.

A group of papers was then read by title or abstract being Topographic Surveys, by Mr. Ogden; Terrestrial Magnetism, by Mr. Schott; Historical Notes Upon Surveying and Surveying Instruments, by Mr. Hoskold;

Fundamental Units of Measure, by Mr. Mendenhall and Recent Experience with Long Steel Tapes, by Prof. Woodward. The last was a particularly valuable paper. In a brief discussion of it Mr. Robert Moore spoke of the very accurate results which he had got in measuring for the positions of the anchor bolts in the construction of the Merchants' Terminal Bridge and Railroad at St. Louis.

Tuesday evening a reception was given by the Committee of the Associated Engineering Societies at the rooms, No. 10 Van Buren street.

ABSTRACTS OF PAPERS.

Mr. R. S. Woodward's paper on the *Use of Long Steel Tapes for Measuring Base Lines* contains little of special interest to railroad men. He gives to Professor Jüderin the credit of first demonstrating that tapes were available for such work. The paper describes the manner of using tapes, the results obtained and the conclusions and rules deduced from the measurement of two base lines of the U. S. Coast and Geodetic Survey.

The chief value of the paper is probably in the formulæ relative to the length of tapes under different conditions of pull, temperature, etc., which are given as an appendix. The comparison of a measured distance by two different tapes, which distance was measured in sections, each section being measured twice and the mean adopted, is interesting. The measurements were respectively 10,636.3 millimeters and 10,639.9 millimeters, or an error of 1 in 3,000, which, according to Professor Johnson's "Treatise on Surveying" is not as good as might be expected if these are the corrected results.

Manufacture and Testing of Portland Cement, by Henry Faija, gives a good practical description of what Portland cement is, and how its manufacture is best attained. The treatment of the raw materials, the methods of mixing them, drying and calcination of them are discussed. The author's experience in different parts of the world enables him to discuss the subject in a comprehensive manner.

He limits the variation of the quantities of the necessary ingredients of good Portland cements to the following figures:

Lime from	58 to 64 per cent.
Silica from	18 to 24 " "
Alumina and iron from	8 to 14 " "

the three substances making together about 95 to 96 per cent. of the whole. He treats the economy of manufacture of cement both as to locality and the mechanical methods to be employed, and shows the advantages of some methods and machinery over others in different localities. The writer says that the value of a cement may be determined by ascertaining the following properties:

1. The time it takes to set.
2. Its soundness and freedom from blowing.
3. The fineness to which it is ground.
4. Its tensile strength at 3 and 7 days.

He considers the second property (2) the most important, for if a cement will "*blow*" and destroy the work of which it is a part, it does not matter as to the other properties; the cement is inferior. The manner of conducting the tests which he proposes is much the same as is in vogue in the profession. He puts great stress upon the age of cement, and recommends that cement always be stored in a dry, cool warehouse for consider able time. Tests should be made at 3, 7 and 28 days after molding, and stress may be applied at a rate of 400 lbs. per minute.

In specifications for Portland cement the author recommends that for: (1) Fineness.—It shall pass through a sieve 625 holes to the square inch, and leave only eight per cent. residue when sifted through a sieve having 2,500 holes to the square inch. (2) Expansion or Contraction or Blowing.—That a *pat* made of aged cement upon a piece of glass in the usual manner, placed, right after gauging, in a vapor bath of 100 deg. Fahr. until it is set quite hard and then put bodily into water at 110 to 115 deg. Fahr.; shall not when taken out 24 hours afterward come off the glass, show cracks, be friable on the edges, or be much curved on the under side. (3) That briquettes that have been gauged, treated and tested in the usual manner shall carry a tensile stress of 250 lbs. at end of three days, and if slow setting at end of seven days an increase of 50 per cent., and at end of 28 an increase of 75 per cent., or at least have 350 lbs. per square inch at end of seven days and a strength of 350 lbs. at the end of 28 days.

DIVISION B—MECHANICAL ENGINEERING.

At Tuesday's meeting of the Mechanical Engineering section, papers were read by Prof. W. F. M. Goss on Tests of the Purdue University Locomotive. He described the locomotive and the method of making tests and gave tabulated data of tests that have been made with it.

Mr. William Forsyth read the report of the committee to recommend a standard method for testing efficiency of locomotives. The report of the committee brought out some discussion by Mr. George Gibbs, Professor Lanza, Professor Denton and Mr. Forsyth. Professor Lanza asked what error there would be in reading the height of the water in the water-gauge glass before and after the test. Mr. Forsyth and Mr. Gibbs thought that the error thus introduced was well within the limit of error and need not be considered. Professor Lanza thought that if two indicators could be used on each cylinder and the pipe connection with the cylinder made as short as possible, the tests would be more accurate.

Mr. GIBBS: In tests made with long and short-pipe connections I have found no difference in the diagrams obtained.

Professor DENTON: I would urge upon the members of the Mechanical Engineers' Association the necessity of adopting a resolution that will be presented later providing for the appointment of a committee to make shop tests of the efficiency of a simple and a compound locomotive at Purdue University. Heretofore the great objection to making shop tests has been to arrange a brake suitable to absorb the work done by a locomotive; this difficulty has now been surmounted by Professor Goss and such tests can be readily made at Purdue University with the apparatus that is already in place.

Concerning the other papers read, only a few remarks were made.

M. Mallet read a paper on "Locomotives Operated by Total Adhesion on Curves of Small Radius." He compared locomotives of various designs for curves of small radius, the only one of American design mentioned being the Johnstone. Mr. A. von Borries' paper on "The Development of the Compound Locomotive" described compound locomotives of various designs. In discussing the paper Mr. von Borries remarked that two cylinders were enough for any engine, simple or compound, as the aim should be to reduce the number of parts.

Mr. Albert Schneider read a paper on experiences in the construction and operation of rack railroads. The paper dealt specially with the Abt system as designed for the Harz Railroad. In the discussion it was remarked that the Baldwin compounds were doing excellent work on the Pike's Peak Railroad.

One of the interesting features of the day's session was the report of the standing committee on the adoption of a standard method of testing materials of construction. The report suggested that delegates be appointed to conferences, international in character, and that the conclusions of such representatives might be made available to all branches of engineering.

Longridge's Axle-Box.

The axle-box illustrated is manufactured by the Patent Axle-Box Foundry Company, Limited, from the designs of Capt. C. C. Longridge, Managing Director of the company. The woolen pad lubricators employed in the widely known Austin's axle-boxes, which have long been a specialty of this firm, leave nothing to be desired with lubricants of suitable viscosity. Their action is, however, impaired by thick or impure oils, which have no detrimental effect on the working of the mechanical lubricator of the box under notice.

This lubricator consists of a metal disc, clearly shown in fig. 1, mounted freely on a spindle, and maintained in frictional contact with the end of the journal by means of a spiral spring. A triangular shaped scraper rests freely on the rim of the disc and directs a stream of oil on to the surface of the packing plate, whence it is led by suitable channels to the journal. The oil thrown into the upper part of the box by the action of centrifugal force also gravitates in the same direction, and the supply of lubricant is thus augmented as the speed increases. The stud upon which the disc rotates is fixed to a crossbar, as shown in fig. 2, which may be adjusted as the journal wears up into the brass. The practical trials to which the device has been subjected showed, however, that no inconvenience resulted when the stud was upward of one-half inch below the centre of the journal.

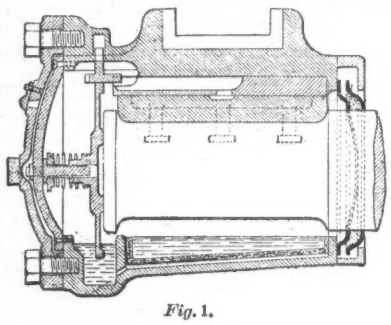


Fig. 1.

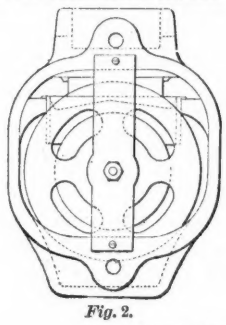


Fig. 2.

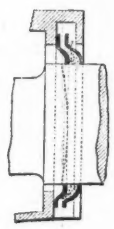


Fig. 3.

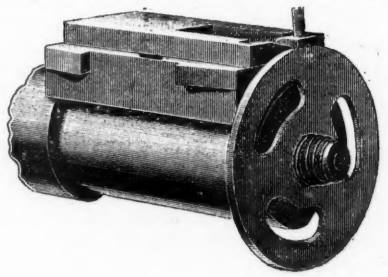


Fig. 4.

Longridge's Axle-Box.

The drip from the axle is received upon a lining of felt (fig. 1), through which it percolates, and, free from solid impurities, returns to the lubricator well.

The design also includes a new form of dust shield, consisting of a plate with a conical recess bored to fit the axle, and provided with packing which is pressed upon the projection of a second plate by means of a horizontally-acting pair of springs (see fig. 3), the reaction also providing for the closure of the joint between the shield plate and face of casting. When the latter is machined a practically perfect obturation results, and experiments are in progress with a view to determining the capability of this shield to maintain an oil bath around the journal for a lengthened period.—*Engineering.*

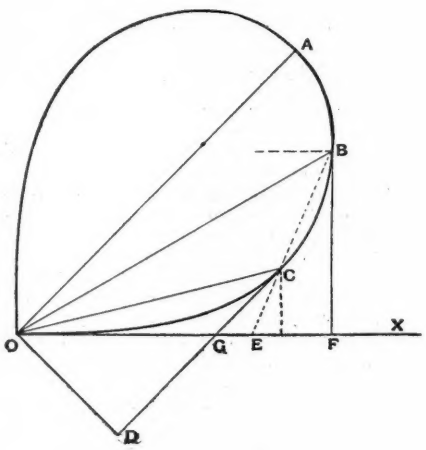
A New Transition Curve—The Lemniscata.

BY CHARLES H. TUTTON.

While the subject of transition curves has been pretty thoroughly written up, yet there is much labor connected with the field use of them. The following is offered as a simple form.

The purely mathematical work is incidental to the final results which are of such a nature that no extra field book of tables will be found necessary, the curve being handled as easily as the circle. While the exact formulæ are deduced, it is shown how they may be modified so that there will be no practical error. The first time that the writer noticed this form of transition curves was in an article by Professor Airy, in *Van Nostrand's Magazine* for 1869, and which has since been amplified by Professor Jameson in *The Railroad and Engineering Journal* of 1889, on the cubic parabola. Professor Airy states: "The chief advantage of this curve is that it follows the tangent very closely for a long distance after leaving it, and thus the change of curvature is at first very gradual, which is the object in view." The curve suggested by Professor Talbot in the *Railroad Gazette*, July 31, 1891, and that by D. E. Hughes, in *Engineering News*, for Dec. 29, 1892, are one and the same, although handled in a different manner.

The curve proposed will be found to be so close to both of the above mentioned curves that it will only be by laying them out *full size* that the difference will be appreciable,—yet it is capable of very easy solution and practical location.



In the first place it is evident that the curve must be a spiral because it is of the general form $u = f(\theta)$. Now the subtangent of *any* spiral in polar co-ordinates, when $C\,O\,G = \theta$, $O\,C\,G = \varphi$ and $C\,G\,E = \psi$, is $r^2\frac{d\theta}{dr} = r \tan(\psi - \theta) = r \tan \varphi$. If it is assumed that $\varphi = m\,\theta$ then subtang. $= O\,D = r \tan m\,\theta$. But $r \tan m\,\theta$ is the subtangent of *any* spiral whose general equation is $r^m = a^m \sin m\,\theta$, and, if $m = 2$, the equation becomes the lemniscata

$$r^2 = a^2 \sin 2\theta. \qquad (1)$$

This curve consists of four complete loops one of which is shown in the figure.

From this expression the length s of the curve

$$s = a\sqrt{\sin 2\theta}\left\{1 + \frac{1}{10}\sin^2 2\theta + \frac{1}{24}\sin^4 2\theta + \frac{5}{208}\sin^6 2\theta + \ldots\right\} \qquad 2)$$

whence as $\sqrt{\sin 2\theta} = \frac{r}{a}$

$$r = s\left\{1 - \frac{s^4}{10\,a^4} + \frac{1}{120}\frac{s^8}{a^8} - \frac{11}{15{,}600}\frac{s^{12}}{a^{12}} + \ldots\right\} \qquad (3)$$

Again, for the radius of curvature at any point

$$R = \frac{a^2}{3r} = \frac{a}{3\sqrt{\sin 2\theta}} \qquad (4)$$

(It will be noticed that the tangential angle $O\,C\,G$ at any point is double the deflection angle $C\,O\,G$; to the

same point, and the total angle of intersection $C\,G\,F$ is three times the deflection angle $C\,O\,G$.)

From this last equation R is a minimum when sine 2θ is a maximum or $R = \frac{1}{6}\,a$, also by the equation of the curve $r = a$ when $2\theta = 90°$; hence $O\,A$ represents the value of a in the formula.

Now in Mr. Hughes' curve the radius of curvature varies inversely as s, while in the present one it varies inversely as r, whence the two curves will be practically identical so long as s deviates but little from r. In the cubic parabola the minimum radius of curvature R is where $\theta = 8° 28' 40''$ or $8° 29'$, no matter what value the constant may have.

If in equation (2) $\theta = 8° 29'$ then $s = 1.0085\ r$, or for $\theta = 5°$, $s = 1.003\ r$.

For ordinary purposes 5° may be assumed as a maximum value for θ, which means 15° of curvature used at each end of the main curve for the transition curve, or a total central angle of 30°, which is a large angle for a transition curve.

Assuming that 5° be the limit for θ, up to which $s = r$, the formulæ become

$$r^2 = a^2 \sin 2\theta\ (A),\ r = s = a\sqrt{\sin 2\theta}\ (B),\ R = \frac{a^2}{3r}\ (C),$$

$$x = r \cos\theta\ (D),\ y = r \sin\theta\ (E),$$

where x and y represent the distances $O\,F$ and $F\,B$ respectively.

Tare the formulæ necessary to put in the curve. The angles can be readily calculated by which to run this curve backward; still, under ordinary circumstances it will be easier to turn off $G\,C\,O = 2\theta$ from tangent, locate the point O and run it the other way.

For this purpose equations (2) and (3) may be written in the forms: $s = r\,(1 + .000122\,D^2)$ and $r = s\,(1 - .000122\,D^2)$, where D is the deflection angle, and expressed in degrees and decimals of a degree. These equations give the correct difference between values of r as chord and s as arc for values of D up to 8 deg. or 10 deg.

If it be necessary to "move up" on the curve or to run it backward, the deflective angles can be found as follows: It will be found that the spiral departs from its osculating circle at any point at nearly the same rate that it departs from the main tangent; consequently, the deflection from any point on the spiral from the tangent through that point is equal to a circular deflection for the same distance, plus or minus the spiral deflection from the main tangent for an equal distance, the spiral deflection to be *added* or *subtracted* according to whether we run *from* or *toward* the starting or main tangent point.

For greater accuracy this circular deflection must be corrected by $.000016\ s^2$ minutes (s being in feet), which is to be *added* when running *toward* the starting point or *subtracted* when running *from* it. No correction is necessary under $s = 300$ ft.

Example 1.

What will be the degree of our curve and what the deflections, etc., provided we assume $\theta = 5°$ and $x = 500$ ft. From Eq. (*D*) $s = r = \frac{x}{\cos\theta} = \frac{500}{\cos 5°} = 501.91$ ft.,

whence from (*B*) $a = \frac{r}{\sqrt{\sin 10°}} = 1{,}204.7$ ft. and from (*C*) $R = \frac{a^2}{3r}$ or $R = 963.5$ feet, or the curve ends in a 5° 57′ circular curve.

If this curve is run in the usual manner with chords of 100 feet:

First deflection angle, $\sin 2\theta = \frac{s^2}{a^2} = .006891$ ∴ $\theta = 12'$ nearly; $R = 4{,}837$ ft.

Second deflection angle, $\sin 2\theta = \frac{4\,s^2}{a^2} = .027564 = 47\frac{1}{2}'$; $R = 2{,}419$ ft.

Third deflection angle, $\sin 2\theta = 9\,\frac{s^2}{a^2} = .062019 = 1° 47'$; $R = 1{,}612.5$ ft.

Fourth deflection angle, $\sin 2\theta = 16\,\frac{s^2}{a^2} = .110256 = 3° 10'$; $R = 1{,}209.4$ ft.

Fifth deflection angle, $\sin 2\theta = 25\,\frac{s^2}{a^2} = .17227 = 4° 57\frac{1}{2}'$; $R = 967.5$ ft.

and last as assumed $\sin 2\theta = .17365 = 5°$; $R = 963.5$ ft.

It will be observed that successive values of $\sin 2\theta$ are obtained by multiplying the first value by the squares of the consecutive series of numbers 1, 2, 3, etc., representing the number of chords, and also since for small angles the sines of angles are nearly proportional to the angles themselves, we could multiply the first angle found, 11.9′, by this series with very little error. (This series shows that the angles increase in an arithmetical progression whose common difference is double the first term.)

Should we "move up" at the end of our fourth chord, our deflections from the tangent at that point will be as follows. At the end of this chord $R = 1{,}209$ ft. = 4° 44′ circular curve:

Station.	Circular deflection.	Circular corrected.	Spiral deflection.	True deflection.
0	9° 28′	9° 30′	— 3° 10′	6° 20′
1	7° 06′	7° 07′	— 1° 47½′	5° 19½′
2	4° 44′	4° 44′	— 47½′	3° 56½′
3	2° 22′	2° 22′	— 12′	2° 10′
4	0	0	0	0
5	2° 22′	2° 22′	+ 12′	2° 34′
+01.9	2° 24½′	2° 24½′	+ 12′	2° 36½′

If it is run backward, $R = 963.5 = 5° 57'$ circular curve:

Station.	Circular deflection.	Circular corrected.	Spiral deflection.	True deflection.
0	14° 57′	15°	— 5°	10°
1	11° 57½′	12°	— 3° 11½′	8° 48½′
2	8° 59′	9°	— 1° 48′	7° 12′
3	6° 01½′	6° 01½′	— 48′	5° 13½′
4	3° 04′	3° 04′	— 12′	2° 52′
5	07½′	07½′	01′	07½′
+01.9	0	0	0	0

Example 2.

It is required to ease off a 4° curve $R = 1{,}433$ ft. Fix the elements of a transition curve, assuming that this radius will be reached in a distance of $s = 200$ ft.

From the question $R = 1{,}433 = \frac{a}{3r}$ ∴ $a^2 = 4{,}299\ r = 4{,}299\ s = 4{,}299 \times 200$, or $a = 927 +$ feet.

Then $a = 927$; $s = 200 = r$; $R = 1{,}433$; $\sin 2\theta = .04654$, whence $\theta = 1° 20$ and $I = 3 \times 1° 20 = 4°$.

$x = 199.95$, $y = 4.65$. Assuming 4 chords of 50 ft. each, and observing that the sum of the terms of an arithmetical progression where n is the number of terms and d the common difference $= 2f$ or twice the first term, is $S = n^2 f$, whence $f = \frac{S}{n^2}$, the deflections become $f = \frac{80}{16} = 5'$ for the first, $4 \times 5 = 20'$ for the second, $9 \times 5 = 45'$ for the third, and $16 \times 5 = 1° 20'$ for the last.

TECHNICAL.

Manufacturing and Business.

The new American Line steamers now building at Cramp's Ship Yard, Philadelphia, will be fitted through out with Worthington pumps manufactured by Henry R. Worthington, New York. The order for the pumps also covers Worthington feed water heaters, such as are now used on some of the fastest trans-Atlantic liners, the "New York" and "Paris," of the American line, and others. It will be of interest to learn that Worthington pumping engines will be used for the water supply of the city of Osaka, Japan. Worthington pumping engines had worked their way as far east as China up to the time of the awarding of this last contract.

The Morton Safety Heating Co., of Baltimore, has just closed a contract with the Lake Street Elevated Railroad Company, of Chicago, to equip 100 cars of its line with the Morton storage heater. Work will commence Aug. 12. The company will also begin next week to equip a number of cars of the West End Street Railway, of Boston, with the heater.

The following companies have been chartered in Illinois: Gough's Automatic Street Car & Station Indicator, Chicago; capital stock, $500,000; incorporators, Carroll Gough, Neville Begley and Parker Gough. Diamond Car Coupler Co., Chicago; capital stock, $500,000; incorporators, John B. Legnard, F. Stafford, Wiley B Halton, George W. Dickey, Charles Shreve.

Thomas H. Stryker and Edward Comstock, Receivers of the New York Locomotive works, issue a notice of the sale of the tools, supplies, forgings and all other personal property of the corporation to take place at Rome, N. Y., on Sept. 12 and succeeding days.

The American Tube & Iron Company, of Middletown, Pa., with a second plant in Youngstown, O., went into the hands of receivers on July 27. The Court appointed as receivers A. S. Matheson, General Manager of the company; A. W. Momeyer, Secretary and Treasurer, and R. C. Neal, of the Harrisburg Rolling Mill Company. Over 1,500 men are employed at the two plants. Col. James S. Young, who is President of the company, says that its affairs are in good shape, and that it can pay every dollar of debt if time is given.

In the interference case between the American Brake Beam Co., owners of the patents of W. A. Pungs, and the National Hollow Brake Beam Co., priority of invention has been awarded by the examiner of patents to the American Brake Beam Co.

Mairs & Lewis, contractors, of 18 Broadway, New York, have just taken a contract for building 2,500 ft. of double track trestle at West Haven, Conn., for the New York, New Haven & Hartford road.

Charles A. Schieren & Co. have at the World's Fair an aggregate of 60 belts in actual use, running dynamos, motors and generators, all of its "electric" and "perforated" grade, and running in size from 72 to 12 in. wide.

The annual meeting of the stockholders of the Ohio Steel Co., of Youngstown, O., was held a few days ago. The directors elected Henry Wick, President; J. G. Butler, Jr., Vice-President; Myron C. Wick, Treasurer. Contracts have been placed for nearly all the heavy machinery that will be used in the plant. It is expected that steel will be manufactured on July 1, 1894.

A dispatch from West Superior, Wis., says that the Heath Joint Co., which has a plant in connection with the steel plant, has resumed work after being shut down for several weeks. The steel works will be sold by the sheriff Aug. 24.

The King Bridge Co., of Cleveland, O., is at present rebuilding its riveting shop, which was recently destroyed by fire, and expects to have it in operation within 60 days. The new building will give a clear space of 200x320 ft. It will be constructed of brick and iron, and be as near fire-proof as possible. The company will add considerable new and improved machinery, and will be busily engaged for some time on contracts, among which are four spans of about 200 ft. for the city of Des Moines, Ia.; one clear span of 435 ft. for Frankfort, Ky.; a heavy 250-ft. draw span with two 100-ft. approach spans over the Harlem River for New York City; also a 360-ft. draw, with a 250-ft. fixed span, for the Jacksonville Southeastern line over the Illinois River at Havana, Ill.; 1,600-ft. viaduct near Cleveland; 400-ft. four track drawbridge for the New York Central & Hudson River Railroad over the Harlem River in New York, with numerous other bridges for different railroads.

The New York Air Brake is being applied to 1,000 cars for the Wabash, building by the St. Charles Car Co.; 1,400 for the Great Northern line, building by the Haskell & Barker Co., and 500 for the Queen & Crescent, building by the Missouri Car & Foundry Co.

Iron and Steel.

Loudon W. Richards has left the service of the Maryland Steel Co. to take the position of Superintendent of the open-hearth department of the Pottsville Iron & Steel Co.

The Harrisburg Rolling Mill Co., one of the largest creditors of the American Tube & Iron Co., which went into the hands of receivers last week, has shut down, and will be closed indefinitely. Over 400 men are thrown out of work.

The New Albany rail mills and Charles W. Depauw, of New Albany, Ind., assigned on July 22. The rail mills, assets are placed at $400,000, with liabilities of $350,000.

New Stations and Shops.

Contracts have been let for the erection of a new freight house of the Louisville, New Albany & Chicago road in Chicago.

Work on the Southern Pacific's new shops at Ogden, Utah, is progressing steadily but slowly. The stonework of all the buildings will probably be completed, however, before the contract time expires. The assurance is given that the shops will be completed and occupied in the time advertised.

The Shamokin (Pa.) Car Works Co. intends to erect an additional shop 274 × 103 feet in size.

The Drifton, Schuylkill & Susquehanna Railroad proposes to build a 12-stall roundhouse at Roan Junction, Pa. The building will be of iron, 86 × 261 ft., and the iron work is now in course of construction at the Bethlehem Iron Works and the shops at Drifton, Pa.

The Niles Tool Works, Hamilton, O., has completed plans for a new foundry building 120 × 400 ft. in size.

The St. Louis Southwestern has decided upon the immediate commencement of work on the new car shops at Pine Bluff, Ark., the cost of which will be about $75,000. They will be built under the supervision of H. G. Kelley, resident engineer at Texarkana, Ark.

Instruction in Naval Architecture.

The Massachusetts Institute of Technology has recently established a course of naval architecture, the aim of which is to provide a thorough training in the theory and methods of designing and building ships, with a study of the properties requisite for safety and good behavior at sea. It is a four years' course and receives the degree of bachelor of science. It has been developed as an option in the mechanical engineering course for the last five years, and still retains a large portion of the work of that course. Attention is given mainly to merchant steamships, but some attention is given to the design of men-of-war and of sailing vessels. There are lectures twice a week during the third and fourth years, accompanied by exercises in drawing, in which the students make the calculations and constructions described in the lectures.

The Heilmann Electric Locomotive.

This engine was tried June 16, at Havre, on the tracks in the shops at which it has been constructed. The steam engines were tried and run at high speed with very little motion in the machine. One of the electric motors was mounted on a temporary axle and turned at a speed corresponding to 72 miles an hour. It is said that the results of the trial were very satisfactory.

Webb & Thompson Staff Apparatus.

This well known apparatus for working the absolute block system on single track railroads is now controlled, for this country, by the Johnson Railroad Signal Co., of Rahway, N. J., this company having become the sole licensee for the United States. As most of our readers already know, this apparatus consists of electrically interlocked safeguards, placed at either end of a section of single track road, and connected by a line wire, by which the staves giving the enginemen the right to the road can never be wrongfully given out. When an engineman takes a staff to run from A to B it is impossible, until he returns that staff either to the machine at A or the machine at B, for another staff to be given out at either place. Upward of 1,000 of these instruments are now in use in Great Britain, and they are in use on many miles of the government railroads in New South Wales, where express trains run long distances at an average of 40 miles an hour without any inconvenience on account of the staff. The Johnson Company also controls Tyer's train tablet apparatus for this country, a similar device for the same purpose.

The Harper's Ferry Tunnel.

The heading in the new tunnel of the Baltimore & Ohio Railroad at Harper's Ferry, Md., was put through Thurs-

day, July 27. This tunnel, which is 890 ft. long, penetrates the solid rock at Maryland Heights and is a part of the extensive improvements now being made at Harper's Ferry, which include a bridge of nine spans over the Potomac River and the relocation of the line for 10,900 ft. The work was described in the *Railroad Gazette* of Nov. 4 1892.

A New Swiss Electric Water Power Plant.

The communities of Neuchâtel, Loche and La Chaux-de-Fonds, in Switzerland, are about to carry out a comprehensive water power project looking to the utilization of the waters of the River Reuse for the generation and distribution of electric power for general power and lighting purposes. The project provides for damming the river and carrying the water through an artificial channel to a large storage and distributing reservoir at Combe Garrot, immediately above the site chosen for the station. The head of water made available in this way will be about 300 ft., and the channel to be built is to have a capacity of about 177 cu. ft. per second. The normal flow of the river, however, is considerably less than this, averaging about 106 cu. ft. per second, while the minimum flow does not amount to more than about 60 cu. ft. per second. It is, however, rarely the case that the river reaches this low point.

The storage reservoir is to have a capacity of about 3,000,000 cu. ft., and is intended to act as an accommodation during the night and during those hours of the day in which the demand for power will be small, holding the water in reserve for the periods of heavy demand. The proposals now asked for are for the work of carrying the water from the storage reservoir to the power station, the building of the latter, the installation of machinery, comprising water wheels and dynamos, the erection of the electric transmission lines, distances of about 7½ and 11 miles, and putting up of distributing systems. The proposals should be addressed not later than August 31, 1893, to the *Direction des Eaux et du Gaz*, of La Chaux-de-Fonds, from whom, also, all further particulars of the work can be obtained on application. The jury of award will be composed of five members appointed by the councils of the two municipalities.

Bragg's Fender for Street Cars.

The North Adams (Mass.) street railroad has lately made a test of a fender invented by Dr. F. A. Bragg of that town, It consists essentially of a horizontal shelf or platform. made of steel wire netting, which is fastened beneath the front platform of a car, about three inches above the level of the rails, but so arranged that when it strikes an obstruction a catch is released and the whole thing shoots forward about six feet, so that the obstructing object, a man or a child, for instance, is made to suddenly sit or lie down on the netting. The front edge of the fender consists of an inflated rubber tube, designed to break the force of the blow upon the victim.

THE SCRAP HEAP.

Notes.

The Toledo *Blade* reports that on July 27 the "Exposition Flyer" ran from Toledo to Elkhart, 133 miles, in 123 minutes.

The Philadelphia & Reading has adopted the plan of paying its employees with checks instead of cash. The change has been made at a time which will suit the banks to a T.

Cheating of railroads by means of fraudulent pay rolls, which was reported from three different roads last week, is now reported as having been discovered on the Baltimore & Ohio at Newark, O.

The Brooklyn Elevated Railroad has induced the city Board of Tax Assessors to reduce the valuation of its structure from $200,000 a mile to $170,000 a mile, in consequence of the falling off in traffic due to the construction of an electric surface line.

A Topeka dispatch of July 28 reports that C. B. Jewell, the "rain-maker" employed by the Chicago, Rock Island & Pacific road, is still at work on the line of that road, having an assistant to help him. He has a "rain-car" especially fitted for his work.

Felice Tocci, a taxpayer, has applied for an injunction restraining the city of New York from paying its share toward the improvement of Park avenue between 106th street and the Harlem River, which involves the rebuilding of the New York Central Railroad over that portion of its line, and a change in the grade of the street. The law by which the city is authorized to pay for a share of this work provides that the sum expended by the city shall be assessed upon the property, in the vicinity of the change, which is benefited thereby.

The exodus of mechanics, miners and others from Colorado continues to be a novel feature of life in the West. These travelers seem to haunt the freight yards, and board freight trains in such numbers that the railroads are at a loss what to do with them. It was reported at Chicago this week that 1,000 men came to that city (or to the freight yards near by) in one day, and it was said that 400 left Denver on freight trains in one day. It seems likely that these figures are exaggerated, but the Union Pacific has made formal demand on the public officials at Denver for protection. It appears that persons who are not without money sufficient to pay their railroad fare "beat their way" on freight trains, simply because they have a good chance to do so. On Friday last, the five principal lines eastward from Denver carried out 264 passengers on the "relief rate," which means, we suppose, a reduced rate made by an agreement with the city authorities.

The local passenger trains of the New York Central running between Thirtieth street and Spuyten Duyvil, New York City, on the west side of the city, have been so infested by roughs that detectives had to be called upon to preserve order. On July 25 thirty of the rowdies were arrested on one train, 12 of whom were held for trial, and punished, but on the 28th it became necessary to arrest another crowd, of whom six were sentenced to imprisonment for two months. These trains run through the streets for some distance, and run at such low speed that the rowdies can generally escape capture. At Oakland City, Ind., one night last week 30 tramps boarded a freight train of the Evansville & Terre Haute, and the conductor, aided by the city marshal at Princeton, whom he had notified by telegraph, had a pitched battle with them. In attempting to board the train a second time a tramp was killed, after which the rest of them ran away. At Cranesville, N. Y., on the 26th, 14 trespassers were put in jail for stealing rides on freight trains of the New York Central.

Reports of retrenchment on various roads continue to be published. The President of the "Big Four" says that he expects to curtail extensively without delay. The Northern Pacific has discharged men from the shops and general offices and at prominent points along the line. The Great Northern has also discharged some men. The Louisville & Nashville has discharged some men from its Louisville shops and from the general offices. The New York & New England has discharged 45 men from the East Hartford shops. The Westinghouse Air Brake Co. has discharged several hundred men and made serious reductions in the wages of those machinists who are kept at work. The Brooks Locomotive Works have discharged men in several departments.

On the Chicago & Alton the office of Assistant Superintendent has been abolished, and it is announced that the train dispatching of the entire system will be concentrated at Bloomington and that the dispatching offices at Roodhouse, Ill., and Slater, Mo., will be abandoned. Engines have been taken out of service at Joliet and Springfield and one crew at Alton, and the way freight crews were ordered to do yard work. The Bloomington shops will be put upon an eight-hour schedule. A large number of men in the shops have been suspended. The shops of the New York, Lake Erie & Weste[illegible]at Susquehanna are running but 24 hours a week. [illegible] shop of the Central of New Jersey at Brills has sh[illegible]own. Saturday hereafter will be a full holiday with[illegible] pay in all Union Pacific shops, thus reducing the time to 40 hours a week. The Chicago, Milwaukee & St. Paul and the Chicago & Eastern Illinois have reduced the salaries of officers and employees in the general offices 10 per cent. The Rio Grande Western has reduced wages 10 per cent. throughout its system.

South American Notes.

The new sub-marine cable from Salina Cruz, Mexico, to Chorillos, near Lima, Peru, has just been completed, having been laid within a period of 10 months.

The Paraguay Central Railroad has agreed to a moratorium of three to five years, during which period it will accept its guarantee in bonds bearing 4 per cent. interest, and 1 per cent. amortization.

St. Thomas, in the West Indies, has made another bid for larger commerce in removing even the "light dues" of 1 per cent. per ton, hitherto charged, thus removing the last burden upon shipping and making her a free port in the broadest sense of the term.

The Pierce Artesian Co. is executing large contracts for boring artesian wells in various parts of Argentine. The success of the wells already bored has been considerable.

The Argentine Geographical Society has just issued an admirably clear and well executed series of 30 maps, 20 × 15 in. each, showing the entire republic. The work was done under direction of Professor Seelstrang, of Córdoba, and was lithographed by a native firm.

The Rosario, the Great Western and the Great Southern railroads of Argentine have agreed to build, at their own cost, the great central depot for all the roads centring at Buenos Ayres, which was proposed last year. It will be situated on reclaimed lands of the Madero Port, and will be built in accordance with plans adopted by the government.

A correspondent from Argentine gives some idea of the violence of the floods brought down by the rivers rising in the Andes, by stating that on Feb. 28 last, 103 kilometres of the Argentine Great Western Railroad were nearly destroyed. The line was cut in 78 places within this distance, some of the washouts being from 200 to 300 metres in length. In addition nine bridges were totally destroyed, one of these having a length of 1,088 ft.

The city of Pará, Brazil, has sent out a circular, inviting tenders for the lighting of that city by gas, by electricity, or by a mixed system. Particulars of the conditions, which are too lenghty for publication, can be obtained by application to the *Railroad Gazette*, or to J. Coelho, of the Municipal Council of Pará. Bids must be in by Nov. 1. The population of Pará is estimated at 100,000.

An objection which has recently been urged in Brazil against machinery and mechanical appliances made in England may apply with equal force to the United States, and at least deserves consideration by our manufacturers. This objection is that these articles are made in accordance with standard dimensions based upon English weights and measures, whereas the Brazilian standard is the metric system, and the Brazilian workman is used to this system in designing the various fittings, settings, etc., in putting up and operating machinery. Consequently he is puzzled by dimensions to which he cannot so easily work with his metric rule, and he consequently prefers articles of French and Belgian manufacture, which are made upon metric standards.

Railroad Taxes in Missouri.

The State Auditor has just made up the list of assessments for railroad property for the present year's taxation, being based on the mileage as it existed on June 1, 1892. The length of road in the state at that time was 6,167 miles, and the total valuation of railroads and telegraphs is $65,396,928, an increase of $1,511,870 over the preceding year. Of the total amount named, $2,450,000 represents the two bridges at St. Louis, three others over the Mississippi River and five others, 10 in all; and $923,510 represents the valuation of telegraph lines.

Running Passenger Cars Next to the Engine.

This being the dull season the New York *Sun* amuses its readers with the following episode:

One of the Pennsylvania fast trains that do good by bringing Philadelphia within suburban time of New York is known to the railroad people as the "7:30," because it leaves Philadelphia at that hour in the morning. It runs through without a stop, and takes water on the run out of a long trough between the rails near Edgley. A scoop is let down from beneath the tender into the trough. Yesterday morning the first coach of the train contained about thirty passengers. Some of them were women. . . Well, no one was thinking about the water trough or the water, until suddenly the front door of the coach next to the engine was burst in by a broad stream of water, like that thrown from a water tower at a fire. In just one second every man and woman was standing, and in another they were all sitting, sitting on the backs of their seats to keep their feet out of the stream of water that rushed along the car floor with such force as to roll the isle carpet up into a wet wad which landed against the rear door and dammed the flood there, and also prevented the door from being opened.

No one had the remotest idea of what was going on. The passengers were all getting a shower bath and the car was rapidly being converted into a pond. There were a great many cries of alarm, but for once no one offered any advice, for a huge stream of water pouring into the front door of a lightning train on a cloudless day offered no suggestion to even the most expert advice giver. It was very lively while it lasted, but it was all over in 20 seconds. Then the water drained out of the car and the passengers began making investigations, The water tender had been filled before the end of the trough was reached, and while the scoop was still down. The force of the water had knocked off the cover of the manhole in the centre of the rear end of the tender, and the speed of the engine directed the stream from the manhole against the front door and the force was so great as to knock in the door. When the scoop was lifted up the shower ceased. Then the people began mopping themselves with handkerchiefs and some said they thought it was funny. They were the ones who sat in the rear seats. . . .

Railroad Taxes in North Carolina.

The railroad commission has made the following return of property for state taxes: Railroad property, $23,644,345; Pullman cars, $82,568; Western Union Telegraph, $164,270; Postal Telegraph, $27,082; steamboat companies, $298,698. There is $50,000 of steamboat property in dispute. The latter matter the commission refers to the Attorney-General for decision.

LOCOMOTIVE BUILDING.

The Central of Georgia has ordered six 8-wheel passenger locomotives from the Richmond Locomotive Works.

CAR BUILDING.

The Central of Georgia this week placed orders with the Jackson & Sharp Co., of Wilmington, Del., for six passenger cars.

The Lackawanna Refrigerator Transit Company, of Kansas City, Mo., is in the market for 1,000 beef refrigerator cars, delivery to commence early in September.

BRIDGE BUILDING.

Allentown, Pa.—City Engineer Grossart is preparing an estimate of the cost of a proposed bridge from the foot of Fifth street over the Little Lehigh River to Salisbury. The structure will cost $150,000.

Annapolis, Md.—The contract for building the old furnace bridge over the Little Patuxent River has been awarded to the Groton Bridge & Mfg. Co. at $934, being the lowest among ten bidders.

Baltimore, Md.—W. H. Shipley, Bridge Superintendent, has submitted to the county commissioners the plans and specifications for the wooden bridge over Shawan Run on the road from Shawan to the town of Texas. The cost will be $500 to $600. Examiners were appointed to report upon the bridge to be erected over the stream crossing the road leading from Tufton avenue to Mantua Mill.

Casselman, Ont.—The contract for the building of the Casselman iron bridge has been awarded to Mr. Rousseau, of Montreal, who is to have the bridge finished within five months from the date of signing the contract. It is said the contract price is about $6,000.

Chattanooga, Tenn.—The county court has decided to issue bonds to build a new bridge across the Tennessee River. Judge Bennett is Secretary of the Bridge Committee.

Clarion, Pa.—A petition is being circulated praying the Commissioners to rebuild the bridge across the Clarion River, at the mouth of Toby Creek, which was blown down some months ago.

Delaware, O.—The contract for a single span bridge across the river on Central avenue has been awarded to the Toledo Bridge Co., at its bid of $10,860.

Elkton, Md.—The county commissioners of Cecil County have awarded contracts for the erection of two iron bridges over Mill Creek—one at a point near Akin and the other near Bacon Hill, a station on the Philadelphia, Wilmington & Baltimore Road. The contractor for the ironwork is George McQuilkin, of the Enterprise Machine Works, Elkton, at $1,156.

The Cecil and Kent County commissioners will meet in Elkton in August to entertain proposals for building an iron bridge to replace the present wooden one over the Sassafras River, which divides the two counties.

Florence, Ala.—The award to the Detroit Bridge & Iron Works, of Detroit, of the contract for the Florence bridge approaches, was recently noted in this column. The north approach consists of a trestle viaduct 378 ft. long, the spans being as follows: Eight spans, 32 ft. long; one span, 46 ft.; one span, 32 ft. and one span, 44 ft. long. The south approach consists of one 51-ft. deck girder span and one 76-ft. triangular truss span, the

latter span carrying the railroad track on a floor system in the plane of the top chords and a 14-ft. highway on floor beams suspended from the bottom chord. The work will require about 150 tons of steel, and will be constructed in accordance with specifications of the Keystone Bridge Company. The bridge is for the Memphis & Charleston Railroad. The Detroit Bridge Co. also built the bridge proper over the Tennessee River. This was described in this column Nov. 4 last, P. 830. The bridge has 13 deck spans, ranging in length from 114 ft. to 154 ft.

Gallipolis, O.—The contract for the superstructure of the bridge over Racoon Creek has been awarded to the Brackett Bridge Co., of Cincinnati. The main span is to be 125 ft. long, with two other spans of 30 ft. each.

Media, Pa.—Proposals will shortly be invited for the construction of a new bridge at Shoemakerville, to be of iron, with a total length of 443 ft.

Millerstown, Pa.—George F. Goodman, of Port Royal, has received the contract for repairing the county bridge spanning the Juniata River at this point, at his bid of $6,500.

Montreal, Can.—The Park & Island Street Railroad, which is building an extension of its line, proposes to make an overhead crossing of the Canadian Pacific tracks on St. Lawrence street. The bridge will be long, but the actual length is not yet determined, and it will be about 40 ft. wide.

Philadelphia.—The Director of Public Works has awarded the contract for the construction of the bridge at Woodbine avenue and the Pennsylvania Railroad, in the Thirty-fourth Ward, to C. P. McManes for $24,400. The bridge is for carrying the street under the railroad. The contracts for a number of foot bridges across the Richmond branch of the Philadelphia & Reading have also been let. The bridge at Kensington avenue was awarded to P. McManus for $1,830; at Thompson street to M. McHugh & Bro. for $2,369, and at Midvale avenue to C. R. Grim & Co. for $2,490.

Roanoke, Va.—The supervisors of Roanoke County have decided to erect three iron bridges in the county—one over Roanoke River and two over Tinker Creek. W. P. Moomaw is Chairman of the Board of Supervisors.

Warren, Pa.—At a special election held July 25, the proposition to increase the borough debt $5,000 in order to construct a $15,000 bridge across the Conewango Creek, at Fifth street, was indorsed by a majority of 346 out of 564 votes cast. The citizens of the town have subscribed the other $10,000. A contract for the superstructure will be let immediately.

West Chester, Pa.—The County Commissioners have decided to bridge Octoraro Creek, at Harkness' Fording, on the road leading from Ashville to Glen Roy, with a 90-ft. structure, to cost between $2,500 and $3,000. No contract has been let as yet.

Upper Marlboro', Md.—The contract for building a bridge at Upper Marlboro' has been awarded to the Wrought Iron Bridge Co., of Canton, O. The price to be paid is $850.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroa ·

The Federal Court rules that the grant by a city of a right of way to a street railroad company implies a contract not to reassert that right subsequently in favor of another.[1]

The Supreme Court of Illinois decrees that the statute providing that "all regular passenger trains shall stop a sufficient length of time at the railroad station of county seats to receive and let off passengers with safety," applied to a train employed in interstate commerce, is not a regulation of such commerce.[2]

In Nevada it is held by the Supreme Court that the statute which provides that all railroads, however owned, are to be assessed by the state board, and all other property by the county assessors is not in conflict with the provision of the constitution requiring corporations to be taxed the same as individuals, and it makes no improper discrimination between corporations and individuals.[3]

In Indiana in an action against a railroad to recover for lodging and care given to a brakeman who was injured while making up a train, it appeared that the brakeman was removed to plaintiff's house, where he had been boarding for a week; that he remained, from his injuries, unconscious for four days, and was not able to be removed to his home for 25 days; that he had no relatives in the place where the accident happened, and had no means to pay for necessary attention; that, in addition to medical attendance, he required constant care up to the time of his removal; that the general offices of the company were 100 miles distant; that, within 30 minutes after the accident, the conductor of the train, who was the highest officer of the company at that place, went to the house and told plaintiff to take care of the brakeman, and the company would be responsible for the expenses. The Supreme Court rules that such an emergency existed that the contract of the conductor was binding on the company, and that plaintiff could recover.[4]

In Louisiana the Supreme Court rules that the act of 1890, which requires railroad companies to provide equal, but separate, accommodations for the white and colored races, by providing separate cars or compartments for each, does not violate the thirteenth amendment of the United States Constitution, because such accommodations involve no badge of slavery or involuntary servitude.[5]

Carriage of Goods and Injuries to Property.

In the Federal Court it is ruled that the fact that the share of a joint rate taken by one company is less than its local rate for a shorter haul does not constitute a violation of the long and short haul clause.[6]

The Supreme Court of Texas holds that where a carrier, after it has contracted to furnish cars at a certain time for the shipment of cattle, and after the shipper has prepared to deliver them, having them inspected as fast as they can be loaded, stops the loading and gives the cars to another shipper, who has already had his cattle inspected, it is liable to the first shipper for the damages caused by the delay, and is not relieved from liability by the statute making it a misdemeanor for a railroad agent to receive for shipment cattle that have not been inspected, and requiring an inspection certificate and a bill of sale before the shipment of cattle.[7]

In the Federal Court it is held that where each of several competing railroads by an agreement for the purpose of maintaining just and reasonable rates, preventing unjust discriminations by furnishing adequate and equal facilities for the interchange of traffic between the several lines, maintains its own organization as before, elects its own officers, delegates no powers to the association to govern in any respect the operations or methods of transacting the routine business of the several competing lines, but simply requires that each company shall charge just and reasonable rates, and provides for certain regulations in regard to changes in such rates, such contract or agreement is not forbidden by public policy as amounting to a transfer of the franchises and corporate powers of such companies.[8]

In Texas the Supreme Court rules that a common carrier, who agrees to furnish at a certain time and place, if they can be got, cars for the transportation of live stock, and who has the cars applied for on hand at the time and place specified, is not relieved from liability for damages for refusing to receive and ship the stock, after tender of the same by the person making application, because of an unusual and unprecedented accumulation of live stock at such time and place, received in *transitu* from connection carriers and from local shippers.[9]

In Alabama it is laid down that where the contract stipulates that the shipper must notify the company's agent in writing of a claim for injury before removing the animals from the place of delivery, the shipper has a reasonable time after the removal, in case the injury is not then discovered by ordinary diligence, in which to give the notice; and where he removes the animals Dec. 29 and notifies the agent Jan. 4, it is a question for the jury whether the notice was given in a reasonable time.[10]

Injuries to Passengers, Employes and Strangers.

In Missouri the Supreme Court rules that knowledge by a switchman on a railroad of the slanting and dangerous condition of the footboard on an engine, by reason of which he was killed, will preclude recovery for his death, unless he might have reasonably supposed that he could safely work about it by the use of care and caution.[11]

In Tennessee it is held that a rule of a railroad that "conductors, flagmen, brakemen and train porters report to, and receive their instructions from, the master of trains," has no reference to defective appliances, and does not require brakemen to complain to the master of trains of unfit tools furnished them by defendant.[12]

In Alabama it is laid down that where a brakeman who, through the negligence of the engineer, has been injured in going between cars and attempting to uncouple them while in motion, testifies, in an action against the company, that he knew it was against the rules to uncouple cars in motion without using a stick, and there is nothing to show that there was any necessity to uncouple them at the time and place of the injury, a verdict should be directed for defendant, though the particular rule against uncoupling cars in motion may never have been read to plaintiff, and he may have been ignorant of it.[13]

The Supreme Court of Oregon holds that a shoveler to clear an obstruction from a railroad track does not assume the risk of accident from defects in a bridge over which he rides in going to his work, where proper care on the part of the company would have detected the defects and prevented the accident.[14]

The Supreme Court of Georgia rules that in an action by an employee against a railroad company for personal injuries where there was evidence that plaintiff was furnished with a coupling stick to be used till he learned how to couple without it, and that his injury was received after he had learned to couple without a stick, and had on many occasions done so, some of the instances being in the presence of his superior officers, who made no objection, the court properly denied a request by defendant to charge that if plaintiff, in undertaking the service, was furnished with a coupling stick and directed to use it in coupling, but did not use it at the time of the injury, and attempted to make the coupling with his hand instead of the stick, and was hurt in making such attempt, he could not recover.[15]

In Texas a petition alleged that plaintiff was employed by defendant, a railroad company, as a fireman of a stationary engine on a pile-driver car; that, while shoveling coal into the engine one of defendant's locomotives jolted the car and plaintiff was thrown off; that the end of a small house inclosing the engine for the protection of plaintiff had been removed; that the accident would not have happened if the end of the house had been replaced; that defendant had promised to replace it and relying thereon plaintiff remained in its employ. The Supreme Court holds that the facts alleged are within the exception to the general rule that an employee cannot recover for injuries received from defective machinery of which he had notice.[16]

In Alabama the plaintiff, a brakeman, was sent ahead of his train with a red lantern and a white lantern to signal an incoming train, and claimed that while in the discharge of his duty he became sick and fell in an unconscious condition on the track, where he was run over, and that his lanterns both remained on the track so that the engineer should have seen them and stopped. The Supreme Court holds that it was plaintiff's duty to be on the track, and if he became sick and unconscious, and fell and remained there, unable to get away, he was not guilty of contributory negligence; but if he negligently fell asleep, or went wrongfully on the track to signal the train and became sick and unconsciously fell and remained on the track, he was guilty of contributory negligence, and cannot recover, except for wantonness or recklessness on the part of defendant's engineer; but in neither case was he a trespasser.[17]

In Kentucky it is held that a section hand who obeys the order of the section master to get on an overcrowded handcar, with full knowledge of that fact, assumes the risk arising therefrom, and there can be no recovery for his death caused by his falling from the car by reason of its crowded condition.[18]

[1] Fidelity Trust & Safety Vault Co. v. Mobile St. Ry. Co., 53 Fed. Rep., 687.
[2] Ill. Cent. v. People, 33 N. E. Rep., 173.
[3] Sawyer v. Dooley, 32 Pac. Rep., 437.
[4] Toledo, St. L. & K. C. v. Mylott, 33 N. E. Rep., 135.
[5] Ex parte Plessy, 11 South Rep., 948.
[6] United States v. Mellen (D. C.), 53 Fed. Rep., 229.
[7] L. & G. N. v Wright, 21 S. W. Rep., 56.
[8] United States v. Trans-Missouri Freight Ass'n, 53 Fed. Rep., 440.
[9] Cross v. McFaden, 20 S. W. Rep., 846.
[10] Western Ry. of Ala. v. Harwell (Ala.), 11 So., 781.
[11] O'Mellia v. Ks. City, S. J. & C. B., 21 S. W. Rep., 503.
[12] L. & N. v. Kenley, 21 S. W. Rep., 326.
[13] R. & D. v. Thomason, 12 South Rep., 273.
[14] Conlon v. O. S. L. & U. N. Ry. Co (Or.), 32 Pac. Rep., 397.
[15] Cent. R. R. & B. Co. v. Maltsby, 16 S. E. Rep., 953.
[16] Southern Pac. Co. v. Lasch (Tex. Civ. App.), 21 S. W., 563.
[17] Helton v. Alabama Midland Ry. Co., 12 South. Rep., 276.
[18] Bradshaw v. L. & N. R. Co., 21 S. W. Rep., 346.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Rome, Watertown & Ogdensburg, quarterly, 1¼ per cent., payable Aug. 15.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago, Milwaukee & St. Paul, annual, Milwaukee, Wis., Sept. 20.

Velasco Terminal, annual, Velasco, Tex., Aug. 9.

Wabash, annual, St. Louis, Mo., Sept. 12.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Roadmasters' Association* will hold its annual convention at the American House, Boston, Mass., Aug. 16 and 17.

The *American Association of General Passenger and Ticket Agents* will hold its next annual convention in Milwaukee, Wis., Sep. 19.

The *Railway Freight Claim Association* will hold its next annual convention at the Hotel Cadillac, Detroit, Mich., Aug. 9.

The Master Car and Locomotive Painters' Association will hold its next annual convention at Odd Fellows' Hall, Milwaukee, Wis., Sept. 13, 14 and 15. The headquarters of the Association will be at the Kirby House, corner of Mason and Water streets. The programme of this meeting was published in our issue of July 28, p. 575.

The *Western Railway Club* meets in room 730, The Rookery Building, Chicago, on the third Tuesday in each month, at 2 p. m. The meetings have been adjourned to Sept. 19.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 7.30 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except during June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Odd Fellows' Building, corner Ninth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p.m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday except during the months of June, July, August and September.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

New England Roadmasters' Association.

The eleventh annual convention of the New England Roadmasters' Association will be held at the American House, Boston, Aug. 16 and 17, 1893. The convention will open at 1:30 p. m., Aug. 16. After the regular routine business of the Association, the following questions will be taken up for discussion: 1. Best method of relaying rail in main track; details to be observed for insurance of safety and economy; proper handling of rail before placing in track and care of same immediately after it is laid in track. 2. Comparative merits of spring rail and stiff rail frogs, when each kind is properly and thoroughly made. 3. Care of station grounds; under whose direction should work on same be done and responsibility for appearance of the grounds rest? 4. Importance of railroads owning good gravel pits; economy of using good ballast in road-bed maintenance; best and most economical method of loading and unloading ballast. 5. Review of previous year's discussions.

Committees appointed by the Executive Committee will submit reports upon these questions.

Mr. P. H. Dudley, C. E., has accepted an invitation from the Executive Committee to be present, and will read a paper on "Steel Rails; Their Manufacture and Service," treating briefly of all the steps in the process from the pig iron to the finished rail in the track.

The afternoon of the second day will probably be devoted to social recreation. C. B. Lenteil is President and G. L. R. French is Secretary of the Association. The Secretary's office is at Northampton, Mass.

PERSONAL.

—Mr. W. H. Mealy, Superintendent of the San Luis division of the Mexican National, has resigned.

—General Superintendent L. S. Thorne, of the Texas & Pacific, has been elected Third Vice-President of the road.

—Mr. W. W. Atwood has been appointed Manager of the Middlesex Valley Railroad in New York, vice H. S. Stebbins, resigned.

—Mr. Henry G. Wood has been elected General Auditor of the Western Maryland Railroad. This is a new office in the company.

—Mr. E. T. Jeffery, President of the Denver & Rio Grande Railroad, has been appointed Receiver of the Rio Grande Southern road in Colorado,

—Mr. H. F. Houghton, Trainmaster of the Wabash, has been appointed Assistant Superintendent of the Cleveland, Cincinnati, Chicago & St. Louis.

—Col. W. A. Lynch has been appointed receiver of the Pittsburgh, Akron & Western Railroad in a friendly suit. Colonel Lynch is President of the road.

—Mr. John Campbell, Master Mechanic of the Lehigh Valley shops at Delano, Pa., has been promoted to take charge of that company's shops at Buffalo, N. Y.

—Mr. Ralph R. Lee, Superintendent of the Philadelphia & Reading Coal & Iron Company's repair shops, at Pottsville, Pa., died on July 28, of paralysis, aged 59 years.

—Mr. F. W. Cooke, of Evansville, Ind., who was last week elected one of the new Directors of the Evansville & Terre Haute road, has been chosen Vice-President of the company.

—Mr. Ransford F. Mix, of Binghamton, N. Y., who was Assistant Superintendent of the Syracuse & Binghamton division of the Delaware, Lackawanna & Western, from 1874 to 1877, died in Binghamton last week.

—Mr. William A. Carey has been appointed Master Mechanic of the Macon & Northern, which has been operated until recently by the Central of Georgia. Mr. Carey has been Master Mechanic of the Macon, Dublin & Georgia since 1889.

—Mr. Edward H. Bacon, who was formerly connected with the Chesapeake & Ohio, has been appointed District Passenger Agent of the Louisville, New Albany & Texas, to succeed Mr. W. G. Crush, who goes to the Missouri, Kansas & Texas.

—Mr. Ford Woods, heretofore Assistant General Freight Agent of the Peoria & Eastern, has been appointed General Freight Agent, with office at Idianapolis, Ind., and Mr. J. H. Sessions has been appointed Assistant General Freight Agent, with office at Peoria, Ill.

—Mr. A. M. Richards, Assistant Superintendent of the Chicago & Alton, at Bloomington, Ill., has resigned, the office having been abolished to reduce expenses. Mr. Richards has been in the employ of the company 27 years as Agent at East St. Louis and as Assistant Superintendent.

—Mr. Thomas K. Scott will act as General Manager of the Georgia Railroad during the absence of General Manager Green, who has been granted a four months' leave of absence. Mr. Scott is at present Division Superintendent of the Louisville & Nashville, at Anniston, Ala.

—Messrs. Frank Roberts, James A. Peebles and Calvin E. Allen, trainmen on the Kansas City, St. Joseph & Council Bluffs, have each been presented with a gold watch by the railroad company for their bravery and discretion in repelling train robbers who attacked their train on June 16.

—Mr. H. B. Hughes, General Passenger Agent of the Missouri, Kansas & Texas, for Texas, with headquarters at Denison, has resigned that position, to take effect Aug. 15. Mr. Hughes has been General Passenger Agent for the last few years, and was Traveling Passenger Agent on Southwestern roads for nearly 18 years.

—Mr. G. A. Wilson, formerly General Manager of the Interoceanic Railway of Mexico, and well known among the railroad men in Mexico and South America, is dead in Brazil. His father, José Wilson, an Englishman, established the first stage-coach line in Venezuela, between La Guayra and Caracas, long before the railroad was constructed.

—Mr. George M. Taylor, Auditor of Freight Receipts of the Pennsylvania Railroad Company, died at Atlantic City, N. J., last week, aged 58 years. Mr. Taylor had been connected with the Pennsylvania Railroad in various positions for a number of years, having entered the service of the company in 1851. He had been Auditor of Freight Receipts since 1871.

—Mr. J. W. Kendrick, Chief Engineer of the Northern Pacific system, has been appointed Acting General Manager of the railroad, to succeed to the vacancy caused by the death of Mr. W. S. Mellen. He has been Chief Engineer of the road since 1888, and has been connected with the company since 1882.

—Mr. F. C. Batchelder, formerly Chief Train Dispatcher of the Wisconsin division of the Minneapolis, St Paul & Sault Ste. Marie, has been appointed Assistant Superintendent of the Minnesota Division of the same company. Mr. Batchelder has been with the "Soo" line since 1887, and prior to that time was a train dispatcher on the Chicago, Milwaukee & St. Paul.

—Mr. W. E. Fowler has been appointed General Foreman of the car shops of the Rio Grande Western at Salt Lake City. This is a new office and was created to relieve the Superintendent of Motive Power of part of his present duties. Mr. Fowler was formerly General Foreman of the railroad shops at Fort Worth and latterly of the Union Pacific repair shops at Denver.

—Mr. Thomas M. King, Second Vice-President of the Baltimore & Ohio, was this week elected President of the Pittsburgh & Western Railroad, which is now leased by the Baltimore & Ohio. Mr. Henry W. Oliver, who had been President of the railroad when it was reported as an independent line, resigned some months ago, and since that time First Vice-President Orland Smith, of the Baltimore & Ohio, has acted as President.

—Mr. Charles B. Sloat, Traveling Passenger Agent of the Chicago, Rock Island & Pacific, with headquarters at Kansas City, will be the first General Passenger and Ticket Agent of the Chicago, Rock Island & Texas, with temporary headquarters at Bowie, Tex. He will be succeeded at Kansas City by James A. Stewart, who was formerly Traveling Passenger Agent in Kansas and recently Southeastern Passenger Agent at Pittsburgh, Pa.

—The office of Division Superintendent of the Flint & Pere Marquette at Port Huron, Mich., has been abolished, and Mr. L. T. Chubbock has retired. The operation of the narrow gauge system will be under the direction of H. O. Halsted, Agent at Port Huron. The position of Superintendent at Clare, D. Massey, is abolished, and the operation of the Meredith Division will be under the direction of the Train Dispatcher at Clare, W. A. Caruthers.

—Mr. Stephen Noonan, Superintendent of Stations on the Long Island Railroad, has been appointed Superintendent of the New York & Rockaway Beach Division. Frank E. Haff, General Car Agent of the Long Island Railroad, succeeds Mr. Noonan as Superintendent of Stations. Mr. Noonan has been with the Long Island road since June, 1892. He was previously Division Superintendent on the New York & New England and the Boston & Maine.

—Mr. William A. Sprott, Commercial Agent of the Wabash at Cincinnati, has been appointed Division Frieght Agent of the Wabash, vice J. M. Osborn, deceased. Mr. Sprott has been with the Wabash road for over 12 years, starting as clerk in the local freight office at Lafayette. He was promoted until he became Contracting Agent in Mr. Osborn's office, and then to Chief Clerk in the same office. For the last year he has been Commercial Agent of the road at Cincinnati.

—Mr. A. W. Dickinson, who resigned the General Superintendency of the Missouri Pacific system last June, after a long term of service, was surprised at his home at Seymour, Ind., last week by a visit from a number of the division superintendents of the Missouri Pacific, who presented him with a purse of over $3,000 with their good wishes. Mr. Dickinson is now living on a large farm at Seymour and is rapidly recovering his health He has definitely retired from railroad service.

—Mr. William G. Crush, for several years District Passenger Agent of the Louisville, New Albany & Chicago, at Louisville, has been appointed General Passenger and Ticket Agent of the Texas lines of the Missouri, Kansas & Texas. Mr. Crush began his railroad service in 1883 as a clerk in the Auditor's office of the "Monon," and has been on that line ever since, serving as clerk in the Auditor's and in the Passenger Agent's office, and then as Traveling Passenger Agent and District Passenger Agent.

—Mr. E. O. McCormick was this week appointed Passenger Traffic Manager of the Cleveland, Cincinnati, Chicago & St. Louis. It is reported that his salary will be $10,000. Mr. McCormick has been General Passenger and Ticket Agent of the Cincinnati, Hamilton & Dayton since May 1889 and was previously with the Louisville, New Albany & Chicago, holding a similar position. His enterprising management of the passenger departments of these two roads has made him one of the best known of the Western passenger agents.

—Mr. Cecil Gabbett this week resigned as General Manager of the Columbus Southern to give his entire attention to the Savannah, Americus & Montgomery road, of which he is also General Manager. Mr. Gabbett was formerly General Manager of the Central of Georgia and has held that position on the Western Railway of Alabama, the Atlanta & West Point and other Southern roads. He became General Manager of the Columbus Southern in April 1892 and retained that office when appointed to a similar position on the Savannah, Americus & Montgomery in December last. He was also for a time President and General Manager of the Atlanta & Florida.

—Mr. J. E. Rose has been appointed Division Superintendent of the Central division of the St. Louis, Iron Mountain & Southern. He succeeds Mr. H. Flanders, who has been Division Superintendent for three years and had risen to that office from a subordinate position after 15 years of service on the Missouri Pacific system. Mr. Rose, who has been appointed Division Superintendent by General Superintendent Peck, was formerly Superintendent of Transportation on the Cleveland, Cincinnati, Chicago & St. Louis when Mr. Peck was General Superintendent of that road. He was also formerly Division Superintendent on the Baltimore & Ohio Southwestern.

—Mr. George Dole Wadley, General Superintendent of the Central Railroad of Georgia, has resigned, and his resignation has been accepted. Mr. T. D. Kline, formerly General Manager of the Mexican National, has been appointed to succeed him. Mr. Wadley's resignation was due, it is reported, to differences with Judge Speer, of the United States Court. Mr. Wadley has been General Superintendent of the Central of Georgia since May, 1892, and was formerly Chief Engineer of the South Bound road of Georgia, and other Southern roads, and was for some years Chief Engineer of Construction of the Mexican National. Mr. Kline went to the Mexican National in 1888, as Division Superintendent, and became General Superintendent and then General Manager in January 1890, resigning last December. He was formerly Division Superintendent on the Central of Georgia.

—Mr. John Stephenson, the builder of the first street railroad car, died at his home in New Rochelle, N. Y., on July 31. He was 84 years old. Mr. Stephenson's illness was due to a general breaking down of the system. Three years ago he was taken dangerously ill with a complication of pneumonia and grip. His strong constitution enabled him to survive the attack, but he had been very weak ever since. Up to last Thursday week he attended regularly to his duties in the company of which he was president. Mr. Stephenson was born on July 4, 1809, of English and Scotch parentage, near Armagh, Ireland. With his parents he came to New York in 1811, where he lived until his death. He was apprenticed to a coachmaker when he was 17 years old. When he started in business for himself in 1831, he designed and built the first vehicle known in New York as an "omnibus," which was soon followed by others, and he soon had a growing business. The New York & Harlem Street Car Railroad Co., the first in the city, was chartered in 1831, and Stephenson was employed to build a car of an entirely original pattern. His car was first used on Nov. 26, 1832. Other orders from the company followed, and in three years orders were received from Paterson, Brooklyn, Jamaica, N. Y., and from Cuba and Florida. In 1836 Mr. Stephenson purchased ground for a factory at 129th street and Fourth avenue, but before he could build there financial troubles came and he had to give up the property. In 1843 he purchased the site of the present works in Twenty-seventh street, near Fourth avenue, then a rural district. His business increased so rapidly that he paid for the factory and land in seven years. As the first tramways or street railroads were not successful, no attempt to extend them was made in New York until 1852, when charters for the Second, Third, Eighth and Ninth avenue lines were granted. Mr. Stephenson supplied the cars for these roads, and then began the development of his extensive business in building street cars. Mr. Stephenson not only built street cars for American cities, but he has supplied street cars for most of the European cities, including Vienna, St. Petersburg, Lisbon, Valencia and London, and he also exported cars to Cape Town, in Africa, New Zealand, Yokohama and Tokio, in Japan, and the leading cities of Australia. The factory in East Twenty-seventh street, New York, now employs 500 men, and can turn out cars at the rate of 25 a week. It has turned out 10,000 closed cars, and, including cable, electric and open cars, 25,000 cars have been built by Mr. Stephenson. The business is now run as a stock company.

—Mr. William S. Mellen, General Manager of the Northern Pacific system, died suddenly at Victoria, B. C., in the night of July 26, of neuralgia of the heart. Mr. Mellen was on an inspection trip of the Western Lines of the system accompanied by a number of the officers and appeared to be in his usual health. President T. F. Oakes, of the Northern Pacific, in announcing the death of Mr. Mellen, says: "Mr. Mellen began his railroad career early in life upon the Chicago & Northwestern Railroad. By successive promotions he passed through the various grades until he was made General Manager of the Wisconsin Central in 1886, and of the Northern Pacific system in 1889. A man of strong physique, a tireless worker, he was devoted to the interests of the company, which he served with conspicuous faithfulness and ability; while by mingled firmness and consideration he won the regard of all employees. He had mastered the business of management. His death removes a valuable and useful officer, whose services to this company will long be held in grateful remembrance."

Mr. Mellen was held in the highest regard by the officials and employees of the Northern Pacific, as well as by all those who were personally acquainted with him. He leaves a wife and four children. The funeral was held at Evanston, Ill., on Tuesday, Aug. 1.

Mr. Mellen was in his 48th year at the time of his death, and had been in railroad service for 28 years. He was born at Crete, Will County, Ill., on Feb. 26, 1846, and entered the service of the Chicago & Northwestern in December, 1865. Until March, 1867, he was a telegraph operator. At that time he was appointed agent at Racine, Wis. He continued in that position until 1870, when he was transferred to Green Bay as agent, where he remained until 1872, when he was appointed General Freight Agent of the Green Bay & Lake Pepin Railroad. In 1873 he re-entered the service of the Chicago & Northwestern Company as General Agent at Winona, Minn., and from 1875 to 1880 he was Assistant General Freight Agent of the same company. From 1880 his advancement was rapid, and in 1881 he became General Superintendent of the Atchison, Topeka & Santa Fe. In October, 1882, he returned again to the Chicago & Northwestern as General Freight Agent, continuing in that position until February, 1885, when he was appointed Assistant General Superintendent of the same road. In October, 1886, he was chosen General Manager of the Wisconsin Central, and when the latter road was leased by the Northern Pacific on July 1, 1889, he was appointed General Manager of that company.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio Southwestern.—Jesse Neer, formerly Passenger Agent of the Ohio & Mississippi at Springfield, Ill., has been appointed Division Passenger Agent of this road, with headquarters at Springfield, Ill.

Big Stone Gap & Powell's Valley.—A. B. Eaton has been appointed Superintendent and W. C. Harrington Secretary and Treasurer of this company, both with office at Big Stone Gap, Va.

Central of Georgia.—John A. Jackson has been appointed Commercial Agent of that company with headquarters at Nashville, Tenn., vice S. W. Edwards resigned. B. R. Price has been appointed General Agent at Philadelphia, vice J. P. Beckwith, transferred to be General Agent at Jacksonville, Fla., vice Mr. Price, who goes to Philadelphia.

Cherry Springs.—The first Directors are: M. E. Olmsted, Harrisburg, Pa., President; W. I. Lewis, Coudersport, Pa.; W. H. Sullivan, Austin, Pa.; H. A. Avery, Forest House, Pa.; S. T. Johnson, H. Hutchinson and G. B. Rooth, Austin, Pa.

Chicago, Milwaukee & St. Paul.—L. L. Austin, formerly Assistant Claim Agent of the Wabash, has been appointed General Claim Agent of this road.

Chicago, Rock Island & Pacific.—F. W. Segur has been appointed General Agent, with office at Kansas City, Mo., vice J. A. Wentz. J. A. Wentz has been appointed Commercial Agent with office at Chicago, vice J. H. Long. C. J. Phillips, formerly Traveling Freight Agent at Davenport, Ia., has been appointed Live Stock Agent, with office at Des Moines, Ia. J. R. Graham, Jr., has been appointed Division Freight Agent, with headquarters at Des Moines, Ia., vice W. W. Loomis.

Chicago, Rock Island & Texas.—J. A. Stewart, Southeastern Traveling Passenger Agent of the road, with headquarters at Pittsburg, has been transferred to Kansas City, Mo., as Southwestern Traveling Passenger Agent, vice C. B. Sloat, resigned to accept service with the Chicago, Rock Island & Texas road. J. A. Sheppard has been appointed Southeastern Traveling Passenger Agent, with headquarters at Chicago, vice J. A. Stewart, transferred.

Cincinnati, Hamilton & Dayton.—D. H. Roche has been appointed Division Freight Agent, with office at Cincinnati, O.

Cleveland, Akron & Columbus.—P. G. Joyce has been appointed commercial agent with headquarters at Columbus, and C. J. McCaffrey traveling freight agent, vice Joyce, transferred.

P. H. Rutledge, formerly Contracting Agent, has been appointed Passenger Agent, with office at Zanesville, O.

Cleveland, Cincinnati, Chicago & St. Louis.—H. M. Griggs has been appointed General Southern Freight Agent, with headquarters at Cincinnati, O. W. W. Root has been appointed General Western Freight Agent, with office at Kansas City, Mo.

E. O. McCormick, General Passenger Agent of the Cincinnati, Hamilton & Dayton, has been appointed Passenger Traffic Manager of the railroad.

Columbia, Newbury & Laurens.—This company elected the following officers at its recent annual meeting: W. G. Childs, President; directors, H. Walters, R. C. Hoffman, W. T. Elliott, John C. Winder, J. R. Kenly, W. A. Roach, H. S. Moseley, George Mower, W. T. Martin, Charles W. McCreery, W. A. Clark and W. H. Lyles. The road is leased jointly to the Seaboard Air Line and the Atlantic Coast Line.

Duluth Transfer.—The office of Thomas S. Krutz, Vice-President, has been removed from Boston, Mass., to the Mills Building, New York City.

East Tennessee, Virginia & Georgia.—F. M. Jolly, previously District Passenger Agent, has been appointed Western Passenger Agent, with office at Dallas, Tex. W. H. Doll, heretofore Traveling Passenger Agent, has been appointed District Passenger Agent, with headquarters at Jacksonville, Fla.

Escanaba Western.—The incorporation of this company was referred to last week. The incorporators of the company are Carver Remington, Franklin Remington, Frank C. Horn, Walter Olds and Herbert A. Morse, of Chicago; Charles F. Griffin, of Hammond, Ind., and T. B. Leiter, of Sheridan, Mont.

Georgia Pacific.—This road is hereafter to be operated by the Receiver independent of the Richmond & Danville, instead of as the Georgia Pacific Division of the road. The following officers have been appointed: W. H. Green, General Manager; A. B. Andrews, General Agent; Sol Haas, Traffic Manager; A. S. Dunham, Comptroller; John W. Hall, Treasurer; W. H. Marbury, Assistant Treasurer, and H. L. Bond, Jr., General Counsel. The Receivers are Samuel Spencer, F. W. Huidekoper and Reuben Foster. General Manager Greer issued an order on Aug. 1 announcing the appointment of the following additional officers: W. B. Ryder, Superintendent; J. P. Minetree, General Purchasing Agent; R. D. Wade, Superintendent of Motive Power; C. M. Bolton, Chief Engineer; C. A. Darlton, Superintendent of Telegraph. These officers all hold similar positions on the Richmond & Danville.

Little Falls & Dolgeville.—At the annual meeting held in Dolgeville, N. Y., July 19, these officers and directors were elected: President, Carl Amann; Vice-Presidents, Titus Sheard and Alfred Dolge; Secretary and Treasurer, Edmund R. Wanckel; Directors, Carl Amann, Titus Sheard, Alfred Dolge, William G. Milligan, Jonas S. Barnet, Judson J. Gilbert, Edmund R. Wanckel, Karl Fink, Edward A. Brown, Henry Faville, Julius Breckwoldt, Edward Dedicke and Ernst Polscher.

Minneapolis, St. Paul & Sault Ste. Marie.—F. C. Batchelder, formerly Chief Train Dispatcher of the Wisconsin Division, has been appointed Assistant Superintendent of the Minnesota Division with headquarters at Minneapolis, Minn. George A. Soule has been appointed Roadmaster of the fourth district of the Minnesota Division, from Harvey, N. D., to the boundary, with headquarters at Harvey.

Missouri, Kansas & Texas.—The jurisdiction of W. B. Lyons, Division Superintendent, has been extended to include the St. Louis Division. Edwin Adams has been appointed General Freight and Ticket Agent for Kansas and Indian Territory, with office at Parsons, Kan., vice C. P. Rector.

Montana Central.—The following directors were elected at a meeting held in Helena, Mont., July 24: Samuel Hill, Minneapolis, Minn.; M. D. Grosser, St. Paul, Minn.; A. J. Shores, Great Falls, Mont., and C. W. Cannon and W. A. Chessman, of Helena, Mont.

Monterey & Mexican Gulf.—Charles M. Barnett, Chief Clerk of the Mexican International general freight department has been appointed Assistant General Freight and Passenger Agent of this road, with headquarters at Monterey, Mex.

New York & New England.—W. J. Dunlap has been appointed General Storekeeper of this company, with headquarters at Norwood Central, Mass.

Norfolk & Western.—H. H. S. Handy, Division Engineer of Maintenance of Way, has been promoted to be Superintendent of the Winston-Salem Division, vice H. Barger, transferred to the Kenova Division.

Northern Pacific.—Chief Engineer John W. Kendrick has been appointed Acting General Manager of the Northern Pacific, to succeed the late W. S. Mellen.

Port Royal & Augusta.—John H. Averill, Receiver, announces that W. A Moore, Superintendent, having tendered his resignation, the office of Superintendent has been abolished. W. J. Craig having resigned as General Freight and Passenger Agent, to accept service with another line, R. H. Wright has been appointed to succeed him with headquarters in Augusta, Ga. A. E. Glover has been appointed Train Master, with headquarters at Augusta, Ga.

Poughkeepsie & Eastern.—Percy Metcalf has been appointed General Passenger Agent and Car Accountant with office at Poughkeepsie, N. Y., vice C. W. Way.

Richmond & Danville.—Samuel Spencer, F. W. Huidekoper, Reuben Foster issue an order under date of Washington, D. C., July 28, announcing that by the several decrees of the Circuit Courts of the United States for the Eastern District of Virginia, the Western District of North Carolina, the District of South Carolina, and the Northern District of Georgia, in the several causes therein pending of the Central Trust Co., of New York, trustee, v. the railroad company, they have been appointed Receivers of the company, and have received possession from F. W. Huidekoper and Reuben Foster, Receivers, of all the railroad property, and assumed the charge and operation of the road on July 31. The following officers have been appointed: W. H. Green, General Manager; A. B. Andrews, General Agent; Sol. Haas, Traffic Manager; A. S. Dunham, Comptroller; John W. Hall, Treasurer; W. H. Marbury, Assistant Treasurer, and H. L. Bond, Jr., General Counsel.

Rio Grande Southern.—The office of General Passenger and Ticket Agent of this company has been abolished, and communications relative to passenger and ticket business should be addressed to Otto Mears, President.

Rio Grande Western.—At the annual meeting, held in Salt Lake City, Utah, July 24, the old board of directors was re-elected as follows: William J. Palmer, George Foster Peabody, Edwin Packard, Charles J. Canda, Spencer Trask, James C. Parrish, New York City; D. C. Dodge, Denver, Col.; Joseph D. Potts, Philadelphia, Pa., and Berthold Schlesinger, Boston, Mass.

St. Louis, Iron Mountain & Southern.—J. E. Rose has been appointed Superintendent of the Central Division of the company, with headquarters at Little Rock, Ark.

Seattle & Montana.—S. A. Smart has been appointed General Baggage Agent of the Pacific coast lines of the Great Northern, with office at St. Paul, Minn.

Sevier Valley.—The annual meeting of this road was held at Salt Lake City, Utah, July 25, and the following directors were elected: David C. Dodge, Robert Harkness, Theron Geddes, A. E. Welby and W. F. Colton. The officers elected were: David C. Dodge, Denver, Col., President; Robert Harkness, Vice-President, and W. F. Colton, Secretary and Treasurer, Salt Lake City, Utah.

Silver Springs, Ocala & Gulf.—J. W. Kelly has been appointed Acting Auditor and Claim Agent, with office at Sanford, vice P. V. Lang, resigned.

Terre Haute, Saylor Springs & Mount Vernon.—The charter was filed in Illinois this week. The names and residences of the incorporators are as follows: Lewis W. Barnes and B. F. Scaife, of Saylor Springs, Ill.; G. W. Evans, of Mount Vernon; Christopher E. Hilts, of St. Louis, and C. B. Cole, of Chester, Ill. The first Board of Directors is: Lewis W. Barnes, B. F. Scaife, G. W. Evans, C. E. Hilts, C. B. Coie, C. M. Thomson and John Ridgeway.

Tintic Range.—The annual meeting was held in Salt Lake City, Utah, July 26, and the following directors were elected: D. C. Dodge, Robert Harkness, Theron Geddes, E. A. Greenwood and W. F. Colton. The officers elected were: D. C. Dodge, President; Robert Harkness, Vice-President, and W. F. Colton, Secretary and Treasurer.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Boston & Maine.—The company since Jan. 1 has laid a second track on the Gloucester Branch, Eastern Division, from Beverly to West Manchester, Mass., a distance of 5.8 miles.

Boston & Nova Scotia Coal & Railway Co.—The contract of Garson, Purcer & Co., of St. Catherines, Ont., noted in this column last week, is for the grading and tracklaying of the whole line from the mines at Broad Cove to Orangedale station, Cape Breton, on the Intercolonial Railroad, the distance being 35 miles. The contractors will commence work on both ends of the line as soon as they can remove their outfit.

Central of Pennsylvania.—The construction work is being pushed from both ends of the road, and at present nearly 500 men are employed on the grading. All the work now being done is under the supervision of J. W. Gephart, of Bellefonte, Pa., the Superintendent of Construction. No contractors are employed. About 15 miles has been graded ready for the rails. The line is being built from Bellefonte, northeast to Mill Hall, on the Beech Creek, and trains will be run into that company's station at Mill Hall. The distance is 27 miles and the line is to be in operation before next January.

Cherry Springs.—The charter of this company filed in Pennsylvania is for a short branch line from Hulls to a point two miles from Cherry Springs, all in Potter County, Pa. The capital stock is $135,000. M. E. Olmsted, Harrisburg, Pa., is President.

Duluth, Missabe & Northern.—The Duluth extension of this road is practically completed. The track has been laid from Columbia Junction to the ore dock at Duluth. The first trainload of ore was shipped over the line continuously from Mountain Iron, and unloaded at the dock in West Duluth on Saturday, July 22, as noted last week. The Duluth extension embraces 24½ miles of single track, laid with 60-lb. rails, comprising that portion of the line between Columbia Junction and the railroad yards, together with 5½ miles double track laid with 80-lb. steel rails, extending from the railroad yards to the ore dock. The line crosses the Cloquet River on a Howe truss bridge of 150 ft. span, at a mean elevation of 45 ft. above the water. The approaches to this bridge consist of 1,800 ft. of trestle from 24 to 36 ft. in height. The Kingberry Creek in West Duluth is spanned with two Howe truss bridges, side by side, for double track. The West Duluth Incline Railroad is crossed with an overhead crossing of double track trestle 1,600 ft. in length, averaging about 22 ft. in height. Keen Creek in West Duluth is crossed by a similar structure 900 ft. long and an average height of 20 ft. The approach to the ore dock is by an elevated double track trestle from 30 to 50 ft. in height, 7,330 ft. in length. All important street crossings in the ore dock approach consist of steel girders constructed by the Youngstown Bridge Co., Youngstown, O. The Duluth Transfer Railroad and the St. Paul & Duluth tracks are crossed by similar structures. The ore dock proper is 2,800 ft. in length, 98 ft. in width, 52 ft. in height, and has a greater capacity than any similar work yet constructed. The grading and tracklaying on this work was done by Wolfe & King, contractors, of Duluth, who began the work in the latter part of February last, prosecuting the same under very adverse circumstances on account of the extreme depth of frost and snow. A large percentage of the material handled consisted of hardpan and cemented gravel, the balance of the material being principally sand, clay and muskeag, also numerous rock in vicinity of Duluth. The company has under construction an extensive system of terminal yards located about five miles out from the ore dock. C. H. Martz, of Duluth, is Chief Engineer and G. J. Anderson is Superintendent of Construction.

Everett & Monte Cristo.—The tracklaying on this road, will be completed to the end of the line at Monte Cristo, Wash., this week probably, after which it will take two or three weeks longer to build the switchback into the town of Monte Cristo. Trains are now running to Silverton, a mining town about 15 miles west of Monte Cristo.

Hutchinson & Southern.—The company is reported to have begun work on the proposed southern extension from the Kansas State line at Cameron station, the present end of track. This line has been surveyed through the Cherokee Indian Reservation toward Guthrie, Oklahoma. The object of the company in beginning work at this time may be to secure subsidies, voted for the extension.

Kansas City, Pittsburgh & Gulf.—One of the directors gives further details about the plans of the company, and says that it is the intention to build to the Gulf of Mexico, connecting at Shreveport, La., with New Orleans and Galveston. "The lumber traffic is not the primary source of profit to which we are looking, our road running through 60 miles of the finest coal land in the Southwest, and through one of the richest agricultural districts in this country. We have iron, lead, zinc, slate, manganese and other valuable minerals along our proposed route, and are assured of a tonnage from coal alone between Kansas City and Pittsburgh, Kan., of 300,000 tons per annum. One of the principal objects in building this air line to the Gulf is to satisfy the increasing demand for a direct grain outlet, as well as the importation into Kansas City from the South of cattle, timber and ties. The money is all raised to build into Fort Smith, Ark., to which city we expect to be operating by January next."

The company is now operating regular trains from Kansas City south to Pittsburgh, Kan., a distance of 136 miles and is building from Pittsburgh to Joplin, Mo., 30 miles. This section is to be ready for operation during the present month. At Joplin connection will be made with the Kansas City, Fort Smith & Gulf, which has been purchased by the above company. That road is in operation to Sulphur Springs, Ark., and has been surveyed south to Fort Smith, a distance of 81 miles. The Texarkana & Fort Smith is also controlled by this company, and is building north through Arkansas toward Fort Smith.

Long Island.—The New York Railroad Commissioners have granted permission for the construction of the Montauk Extension Railroad, in connection with the Long Island Railroad from Bridgehampton, to and along Fort Pond Bay to Collenden Point in Suffolk County. Austin Corbin is the President of the road, which will be about 25 miles long. The officers of the Long Island Railroad announce that construction will begin this year if the right of way along the route is secured.

It has been decided that the tunnel under the Ocean Parkway, at Parkville, N. Y., at which the recent accident occurred, shall be widened from 22 to 30 ft., and a second track constructed. The tunnel will be practically rebuilt.

Los Angeles, Owens Valley & Utah.—Sealed proposals will be received by F. L. Green, at rooms 91-92 Potomac Block, Los Angeles, Cal., until Aug. 15 for the construction of the roadbed of this road, from Mojave, Kern County, to Independence, Inyo County, Cal., of such lengths as the bidder may propose to construct.

Minneapolis, St. Paul & Sault Ste. Marie.—Track layers on the extension to the international boundary have passed Foxholm, N. D., 120 miles beyond Cathay. The graders are well out of the way, and there will be no delay on account of bridges, so the track will advance at the rate of two and a half or three miles a day. On July 31 regular train service was inaugurated between Minneapolis and Minot, N. D.

Nakusp & Slocan.—The promoters of this railroad have completed their financial arrangements, and D. McGillvary & Co. have already forwarded men and supplies for the active commencement of the work of construction in the mining district of British Columbia. The road will be finished by Dec. 1 next. It is to extend from Nakusp, B. C., on Arrow Lake, to the Slocan mining district, and will be operated by the Canadian Pacific.

North Bend & Kettle Creek.—This road is to extend from North Bend to Stone House, near Cross Fork, Potter County, Pa. The work is done by the company under the supervision of Edward Hacket, of Gleasontown, Pa. Six miles of track has been laid, and 7½ miles graded, and the bridges (wooden) built as far as the road is graded. The grades are 104 ft. to the mile, and the maximum curves are 13 deg. The company has 150 men at work, and expects to build about four miles more this summer. It is now operating 4¾ miles of road carrying lumber, bark, coal, etc. It is equipped with two hay engines, 30 logging cars and 16 platform cars. There is no passenger equipment as yet, but the company expects to run passenger trains next summer, commencing about May 1. F. A. Blackwell, of Gleasontown, is President and General Manager, and John W. Kiester is Secretary.

Ohio Southern.—It is expected that the road will be running into the city of Lima, O., in 30 days, as only about ten days will be required to complete the road to the railroad crossing beyond the city limits. The route over which it will enter the city has not been fully decided upon.

Philadelphia & New England.—A dispatch from Harrisburg, Pa., last week, stating that notice had been filed with the Secretary of Internal Affairs that this company had abandoned its projected road and had surrendered its privileges, is denied by W. H. Tinsman, Secretary of the company. He says that the company has not abandoned its road, and if any notice to that effect had been filed it is without authority. The line is projected to extend from Saylorsburg, Monroe County Pa., where it would connect with the Reading system to Port Jervis, N. Y., with branches to points in the interior of New York State.

Rutledge & Julian.—The construction of this line is now going on, although only a small force is employed. The cross ties are being laid over the four miles from Julian on the Alabama Midland to Rutledge, Ala. J. W. Ivey is the contractor for the section of road now being built.

St. Paul, Minneapolis & Lake Superior.—The formation and incorporation of this company was announced several weeks ago. It was the intention of the company to build the line this year from the Twin

Cities to Lake Superior, but so far no contract has been let. The officers say they will not award any contracts or begin work until allthe money necessary for building the line is raised.

Sioux City, Chicago & Baltimore.—Vice-President T. P. Gere announces that arrangements are being negotiated for building the first section of the road from Sioux City, Ia., east 38 miles, this year. By building this much the company will save the $400,000 tax voted by Sioux City.

Sioux Falls, Yankton & Southwestern.—The grading and bridge building is now reported completed on the entire line from Sioux Falls southwest to the Missiouri River at Yankton, S. D. The tracklaying has been commenced at the Sioux Falls terminus, and it is expected to reach Yankton, 60 miles southwest, early in September. The route is being built by United States Senator R. F. Pettigrew, and the local opinion is that the road will be operated by the Great Northern as soon as it is completed.

Toledo & Ohio Central.—The tracklaying on the extension to Columbus is progressing rapidly, and so far about ten miles of track has been laid from Ridgeway, O. It is expected to have the rails laid as far as Marysville this week and to complete the line to Columbus in September. The extension is 60 miles long, and will pass through the towns of Ridgeway, West Mansfield, Peoria, Marysville and Mound to Columbus. There are only two iron bridges on the line, each 100 ft. long. J. S. Casement & Co., of Painesville, O., are the contractors, and C. Buxton, of Toledo, is Chief Engineer.

Victoria & Sydney.—T. W. Patterson, of Victoria, B. C., contractor for this road, has left British Columbia for the East, to purchase two locomotives and other material. About nine miles has been graded from Sydney, and gangs of men are still at work on Victoria Island. The rails, which left England by sailing vessel in March, should arrive in a very short time.

Western Maryland.—The completion of the extension of the Baltimore & Harrisburgh to York, Pa., was celebrated on July 27, and nearly 1,900 people were carried in the excursion trains run over the road on that day. The new line begins at Porter's and extends northeast to York, about 14 miles. The ballasting is now completed to within a few miles of York and regular trains will be put on Sept. 1, two trains running each way daily. The Western Maryland and the Pennsylvania road will build a new station at York.

Wilmington, Newbern & Norfolk.—The extension to Newbern, N. C., was completed last week, the tracklaying having reached that town on July 30. Newbern is a town on the Neuse River, 80 miles northeast of Wilmington. The extension just finished is 31 miles long and begins at Jacksonville. The trains are now running beyond Jacksonville to Pollocksville, 23 miles. The line was built under the charter of the East Carolina Land & Railway Co. H. A. Whiting, of Wilmington, is General Manager.

GENERAL RAILROAD NEWS.

Boston & Albany.—The company reports its earnings for the quarter ending June 30, in the following table:

	1893.	1892.	Inc. or dec.	
Gross earn	$2,625,266	$2,499,039	I.	$126,227
Oper. expen	1,901,205	1,492,438	I.	408,767
Net earn	$724,061	$1,006,601	D.	$282,540
Fixed charges	104,721	100,958	I.	3,763
Surplus	$619,340	$905,642	D.	$286,302

Canadian Pacific.—The statement of earnings for June, is given below:

	1893.	1892.	Inc. or dec.	
Gross earn	$1,890,873	$1,793,277	I.	$97,596
Oper. expen	1,168,546	1,122,127	I.	46,419
Net earn	$722,327	$671,150	I.	$51,177
For six months to June 30:				
Gross earn	$9,459,997	$9,822,189	D.	$362,492
Oper. expen	6,390,727	6,500,005	D.	109,278
Net earn	$3,069,270	$3,322,484	D.	$253,214

Chicago, Burlington & Quincy.—The June statement of the railroad shows decreased earnings, but the expenses were reduced to an extent sufficient to offset the loss in the gross earnings, so that not only the net earnings increased, but the surplus after the fixed charges shows an increase. The comparative figures follow:

Month of June:	1893.	1892.	Inc. or dec.	
Gross earn	$3,292,678	$3,326,295	D.	$33,616
Oper. expen	2,229,874	2,319,805	D.	89,930
Net earn	$1,062,804	$1,006,490	I.	$56,314
Fixed charges	830,000	815,075	I.	14,924
Balance	$232,804	$191,415	I.	$41,389
Since Jan. 1:				
Gross earn	$18,976,008	$18,236,840	I.	$739,168
Oper. expen	13,161,901	12,572,127	I.	589,774
Net earn	$5,814,107	$5,664,713	I.	$149,394
Fixed charges	4,980,000	4,890,450	I.	89,549
Balance	$834,106	$774,272	I.	$59,383

Florida Central & Peninsular.—The newspaper report printed last week that the control of this road had been purchased by the Plant Investment Co., which controls the Savannah, Florida & Western and other roads in Georgia and Florida, was at once denied by President H. R. Duval and other officers, who say that no sale has taken place or is contemplated.

Georgia Southern & Florida.—The foreclosure sale of the road, which was ordered by the court for July 25, has been postponed until November by order of the court, with the understanding that there are to be no more postponements.

Lehigh Valley.—The Philadelphia & Reading Railroad Co., lessee of this road, reports the result of the operations for the month of May, 1893, as follows:

	1893.	1892.	Inc. or dec.	
Gross earn	$1,490,780	$1,567,462	D.	$76,682
Oper. expen	1,044,002	1,042,875	I.	1,127
Net earn	$446,778	$524,587	D.	$77,809
Six months ending May 31:				
Gross earn	$8,893,007	$8,512,469	I.	$380,538
Oper. expen	6,325,884	6,701,199	D.	375,315
Net earn	$2,567,123	$1,811,270	I.	$755,853

Louisville, St. Louis & Texas.—The company defaulted on its first mortgage bond interest, amounting to $160,000, this week. The road earned for the fiscal year ending June 30 $250,000 net and paid out $257,000 for expenses, new construction, etc. The company hoped to borrow funds for the August interest, but could not.

New York, Lake Erie & Western.—The earnings and expenses of this road for the month of June and the nine months of the fiscal year are given in the following table:

Month of June:	1893.	1892	Inc. or dec.	
Gross earn	$2,668,682	$2,742,729	D.	$74,047
Oper. expen	1,704,735	1,794,878	D.	90,143
Balance	$963,917	$947,851	I.	$16,096
Due leased lines	205,814	191,418	I.	14,396
Net earn	$758,133	$756,433	I.	$1,700
Oct. 1 to June 30:				
Gross earn	$22,369,229	$22,992,934	D.	$623,705
Oper. expen	14,957,403	15,644,667	D.	687,264
Balance	$7,411,826	$7,348,267	I.	$63,559
Due leased lines	1,974,899	1,925,890	I.	49,009
Net earn	$5,436,927	$5,422,377	I.	$14,550

Pennsylvania, Poughkeepsie & Boston.—The Philadelphia & Reading Railroad relinquished control of this railroad on July 31, and Receiver H. H. Kingston again took charge of the property. The road is 90 miles long and extends from Slatington, Pa., to Campbell Hall, N. Y.

Philadelphia & Reading.—The earnings for June are reported in the following tables:

	1893.	1892.	Inc. or dec.	
Gross earn	$1,974,748	$1,917,296	I.	$57,452
Oper expen	1,172,992	1,028,289	I.	144,703
Net earn	$801,756	$889,007	D.	$87,251
Other income	76,310	52,622	I.	23,688
Total	$878,066	$941,629	D.	$63,563
Fixed charges	650,000	631,847	I.	18,153
Surplus	$228,066	$309,782	D.	$81,716

The Coal & Iron Co. reports a deficit of $127,187 against a deficit of $103,565 in June, 1892. Both companies show for the month a gross increase of $191,769, a net decrease of $107,823, and a surplus after charges of $100,929, a decrease of $102,288. For seven months of the fiscal year the railroad company has earned over charges $465,262, a decrease of $886,054, as compared with the previous year. Out of net earnings for the seven months $799,583 were paid for equipment. The Coal & Iron Co. for seven months failed to earn charges by $735,334, an increased deficit of $266,202. Both companies for seven months failed to earn charges by $270,071, a loss of $1,152,255.

Philadelphia, Reading & New England.—The Receivers of the Philadelphia & Reading, as was expected, have failed to pay the interest due upon the bonds of this company, which are guaranteed, principal and interest, by the Reading. The Receivers base their action upon the allegation that the interest has not been earned. The May coupons of the company are also unpaid.

Pittsburgh, Akron & Western.—Col. W. A. Lynch, of Canton, O., who is President of the road, was this week appointed Receiver on application of W. C. Mobley in a friendly suit brought to protect the company from threatened litigation and to prevent the appointment of a Receiver opposed to the present management. The company controls the road from Delphos to Akron, O., 165 miles. The line from Carey to Akron, 105 miles, is a new road built in 1890 and 1891. The road between Delphos and Carey, 56 miles, is the old Cleveland & Western, which was entirely rebuilt when the control was secured by the present company.

Rio Grande Southern.—E. T. Jeffery, President of the Denver & Rio Grande, was on Aug. 2 appointed Receiver of the Rio Grande Southern upon the application of Otto Mears, President of the latter company. The road extends from Dallas south to Durango, Col., 162 miles in the southwestern part of the state of Colorado. The stock outstanding is $4,510,000 and the bonded debt is for the same amount.

Sandusky & Columbus Short Line.—The Lake Erie Construction Co. has transferred the road to the stockholders, and the latter have elected the following officers: President, W. E. Guerin, of Columbus; Vice-President, F. J. Picard, Columbus; Treasurer, G. C. Hoover, Columbus; Secretary, E. H. Zurhorst, Sandusky City; Directors, W. E. Guerin, F. J. Picard, G. C. Hoover and H. D. Turney, Columbus; J. H. Stewart, E. H. Zurhorst, H. C. Post and T. B. Taylor, Sandusky City; Charles Andrews, Zanesville; D. B Hatch and Henry Putnam, New York. The road was built in the interest of the Columbus, Shawnee & Hocking, with which the new line has a 50-year traffic arrangement for coal and other freight bound for the lakes. The road was projected by Sandusky capitalists in 1889; work was begun in April, 1892, and completed in January, 1893, since which time the Lake Erie Construction Co. has been operating it.

Union Pacific.—Suit has been begun in the District Court at Omaha by the Chicago, Burlington & Quincy against the Union Pacific to recover $175,000 alleged damages on account of violation of contract. The petition says that a contract was entered into April 27, 1889, by these companies relating to the joint occupancy of several short pieces of track belonging to one or the other of the companies in different parts of the state. The Burlington company claims that it has carried out its part of the contract, but that the Union Pacific has not done so, especially with regard to its line into the stockyards at South Omaha.

TRAFFIC.

Traffic Notes.

The Philadelphia & Reading has discontinued five passenger trains on short branches of the main line division.

Boats on the Erie Canal have taken about 20,000,000 bushels of corn out of Buffalo this year, which is nearly twice the quantity taken to this date last year.

The Interstate Commerce Commission has asked for an injunction in the United States Court in Kansas against the Missouri Pacific, charging that freight rates from St. Louis to Wichita are too high as compared with those to Omaha.

A dispatch from Atlanta states that the through trains for Chicago which were put on in expectation of a heavy traffic to the World's Fair, have not been successful, and the Western & Atlantic and the East Tennessee have each discontinued one through connection.

The Weighing Bureau at Indianapolis is reported to have saved during the month of June $7,773 on carloads and $1,489 on other freight. At Terre Haute, during the same time, the amounts saved were $2,820 and $796 respectively; at Vincennes $286 and $158 and at Evansville $2,455 and $2,008, a total gain at these three places of $17,786.

The Trunk Lines have now run 14 excursion trains to Chicago at half rates and the trains have been well filled. They have averaged a load of 150 passengers each leaving New York and have left Trunk Line territory with an average of over 400 passengers each. The New York, Ontario & Western took the largest load out of New York City, 260 passengers, on July 25. On Saturday last the Delaware, Lackawanna & Western took 240 passengers out of New York. Trains leave New York by two different roads on Monday, Tuesday, Wednesday and Saturday of each week. Commissioner Farmer thinks that these trains will be continued beyond Aug. 19, the date originally fixed for discontinuing them.

Chicago Traffic Matters.

CHICAGO, Aug. 2, 1893.

The Western roads finally agreed upon the plan submitted in the majority report of the committee as outlined last week and have made World's Fair excursion rates from all points where the present excursion rates do not make a lower rate, of one fare for the round trip, plus $2. Tickets are to be good on all trains and carry with them sleeping, chair, and parlor-car privileges. It now remains to be seen whether the further reduction in the rate results in any material increase in travel. Many of the lines are still of the opinion that the comparatively light movement is due to the financial stringency and not at all to rates of fare. A maximum rate of $10 is made for St. Louis.

An important series of meetings of the Managers and General Passenger Agents of the Central Traffic Association lines was held July 28 and 29. The main question under discussion was as to what extent the Association lines would meet the reductions made by the Ohio River lines in World's Fair rates. There was a general disposition shown to confine such rates to the closest possible limits, and a resolution was finally adopted to maintain the present basis of rates from all points where competition did not actually demand a lower, and to continue the running of excursions alternately at half fare, without sleeping-car accommodations. Rates from many points, which had been reduced to meet this competition, were restored. For example, the rate of $5 from Columbus was restored to $8.35; Newark, O., and Mansfield, O., to $10.15.

It is becoming evident that matters in Eastern territory are not progressing quite as smoothly as the roads have hoped for. Still on the whole rates are being better maintained than would have been possible a year ago, and the strong lines are probably inclined to wink at small offenses on the part of the weaker lines rather than precipitate a disturbance, which at this time would probably result in disaster to some of the Association roads. Whether this state of affairs can continue much longer, however, is problematical.

Freight tonnage continues light, with no prospect of any material increase during this month. No rate disturbances, aside from the trans-continental fight, are observable. The Western Passenger Association has voted to allow its roads via Omaha to meet the reduced rates made by the Great Northern and Northern Pacific. Commencing Aug. 1 the following rates were authorized to and from Portland, Spokane, Helena and Butte:

From.	First class.	Second class.
Missouri River	$30.00	$25.00
Chicago	32.00	25.00
St. Louis	35.50	30.50

Tickets are limited to continuous passage. Rates from Chicago apply via all lines through St. Paul and exclusively via the Chicago & Northwestern through Missouri River. Rates from St. Louis apply via all direct lines through St. Paul and via all lines through the Missouri River.

Harvest excursions will be run in Western Passenger Association territory Aug. 22, Sept. 12 and Oct. 10 at a rate of one fare for the round trip, plus $2, tickets good for 20 days.

A disagreement has arisen between the Chicago and the St. Louis lines in regard to rates for the Grand Army encampment at Indianapolis in September. The St. Louis lines are endeavoring to prevent any reductions being made via Chicago, fearing that if reduced rates are made through Chicago the larger portion of the travel will take that route. Eastern lines have already agreed to a cent-a-mile rate for the occasion. The St. Louis lines want to make a rate lower than the combination of World's Fair rates to Chicago plus the cent-a-mile rate east, but are not willing to allow the Chicago lines to quote the same rates.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines, for the week ending July 29, amounted to 49,881 tons, against 47,359 tons during the preceding week, an increase of 1,522 tons, and against 53,872 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to July 29		W'k to July 22.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	6,221	12.5	5,991	12.7
Wabash	3,039	6.1	2,283	4.8
Lake Shore & Michigan South.	10,501	21.1	9,521	20.1
Pitts., Ft. Wayne & Chicago	6,253	12.5	5,796	12.3
Pitts., Cin., Chicago & St. Louis	5,550	11.0	5,913	12.5
Baltimore & Ohio	2,761	5.5	2,692	5.7
Chicago & Grand Trunk	2,910	5.9	3,153	6.6
New York, Chic. & St. Louis	4,249	8.5	4,477	9.4
Chicago & Erie	6,281	12.6	5,376	11.4
C., C., C. & St. Louis	2,095	4.2	2,157	4.5
Totals	49,881	100.0	47,359	100.0

Of the above shipments 1,904 tons were flour, 13,948 tons grain and millstuff, 11,009 tons cured meats, 12,230 tons dressed beef, 2,434 tons butter, 1,535 tons hides and 4,093 tons lumber. The three Vanderbilt lines carried 42.1 per cent., the two Pennsylvania lines 23.5 per cent. The Lake lines carried 90,168 tons, against 66,373 tons during the preceding week, a decrease of 23,795 tons.

(Other Chicago traffic news will be found on page 584.)